SCIENTIFIC AMERICAN

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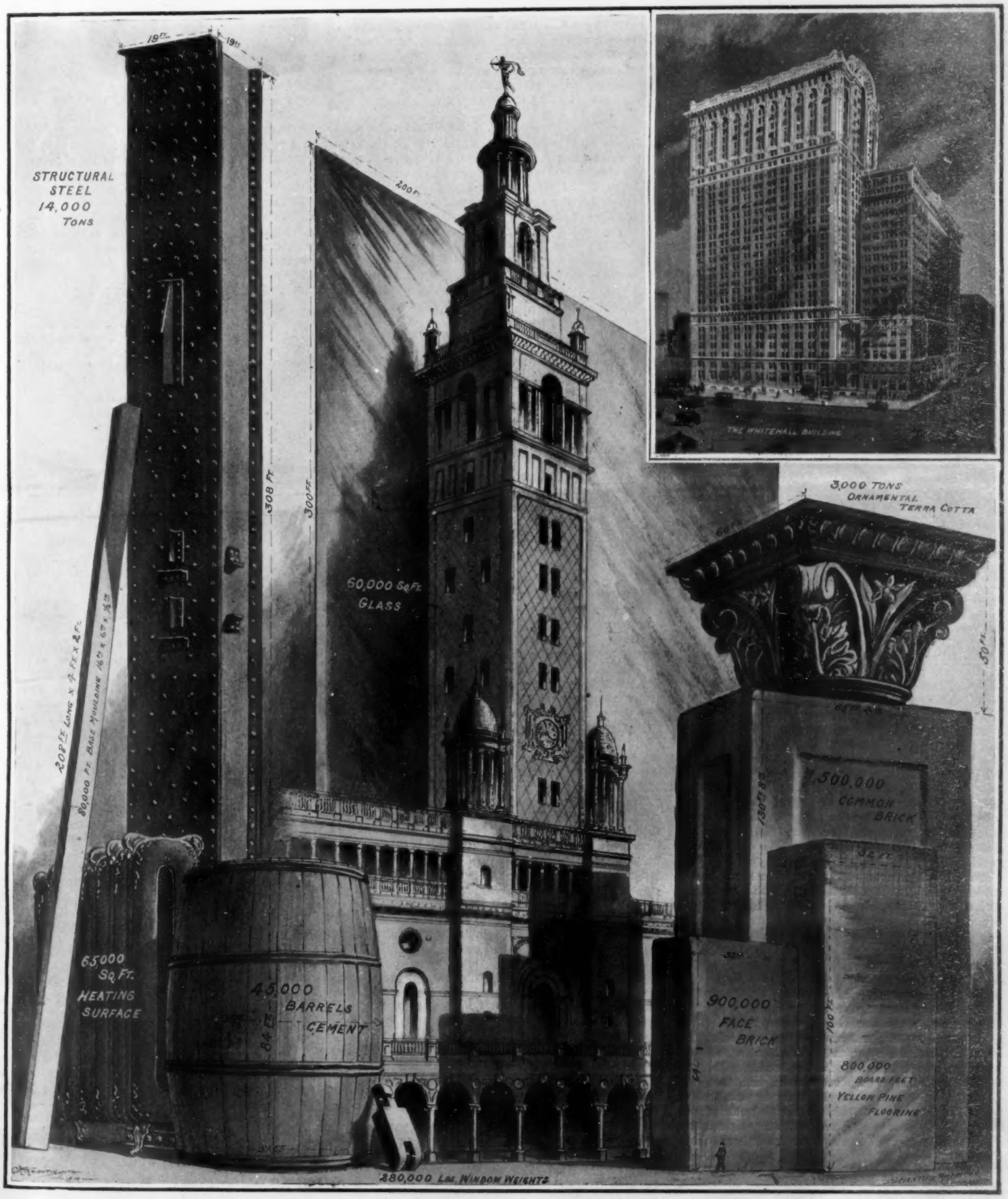

If the principal building materials used in the new Whitehall annex were assembled in Madison Square they would completely eclipse the Garden and Tower.

A MAMMOTH OFFICE BUILDING DISSECTED.—[See page 102.]

SCIENTIFIC AMERICAN
ESTABLISHED 1845

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NEW YORK, SATURDAY, AUGUST 6th, 1910.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE EXTINCTION OF OUR MERCHANT MARINE.

WE seem to be within measurable distance of the time when we shall have to substitute the word "extinction" for "decline" in speaking of our once famous merchant marine, which, in the earlier half of the last century, held a more commanding lead among the fleets of the world than is held to-day by the shipping of Great Britain. In view of the usually quick response of the American people to any appeal which touches their national pride, the general apathy with regard to the disappearance of our ships from the high seas is a problem for which it is impossible to find an adequate solution.

With a reiteration which would become tiresome were not the issues at stake so enormous, it has been proved to a demonstration that the economic conditions in the United States affecting the construction and operation of ocean-going steamships are such, that the only possible way to resuscitate our merchant marine and carry it along until it has attained a sufficiently lusty growth to hold its own in competition with the fleets of the world, is for the Government to step in and afford some measures of relief.

So frequently has the SCIENTIFIC AMERICAN laid before the public the unanswerable arguments in favor of Government assistance that we hesitate to repeat them; but the facts recently given in the investigation before a special House committee by Mr. A. H. Bull, of New York, are so convincing that we feel constrained to repeat them in these columns.

Mr. Bull is the owner of two freight steamships of the same tonnage, one of which sails under the American flag, and the other under the British flag. In order to make his comparison the more complete, the witness put in evidence data which he had gathered from the German naval records regarding the expenses of a similar steamship sailing under the German flag. The total wages of the crew on the American ship per month are $1,470; on the British ship $897.04; and on the German ship $483.82. The pay of the American captain is $175; of the British captain, $100, and of the German captain, $79.75 per month. The American chief engineer receives $150 per month, the British chief engineer $97.20, and the German chief engineer $79.75.

This difference in wages is surely a sufficient handicap in itself; but Mr. Bull states that the higher quality of the food and outfit called for by the United States Government places the American owner at a further disadvantage, the increased expense in this direction being as great as the increased cost of wages. It should be added, however, that the German captain receives a certain percentage of the gross receipts from freight, which makes the compensation of the German and British captains approximately equal.

Returning to the comparison of the two identical ships owned by Mr. Bull and sailing, one under the American, and the other under the British flag, the American ship is under the further handicap that the law requires her to ship seven more men than the British ship. Furthermore, she is never permitted to leave port without a full complement of officers and men, while the British ship may sail short-handed and pick up the balance of her crew at the different ports of call.

Surely the disabilities mentioned above are sufficient in themselves to prove how impossible it is for seagoing ships flying the American flag to compete successfully against the two great maritime nations, Great Britain and Germany, but it is a fact that before the costs of operation come into play, and at the very time that an American-built ship casts off her moorings for her first deep sea voyage, she is already laboring under a heavy handicap represented by the increased cost of construction. For even in our best equipped shipyards the high cost of labor so far offsets our cheap steel that the American-built ship costs more, ton for ton, than does one built in foreign yards. Nor is it at all to the point to quote the case of the Argentine battleships, the contracts for which were secured by American builders largely because they were able to underbid foreign shipyards. The firms which are building these two battleships are in a combine which includes one of the largest steel and armor manufacturing plants in this country, and the builders consequently did not have to figure on the heavy royalties on armor, and the usual profits on the structural and plate steel used in the construction of the hull.

An American traveler, happening to be in Singapore, and observing the total absence of the American flag from that busy haven, had the curiosity to investigate the records of the port and ascertain the true conditions. He found that out of over 20,000 vessels that had cleared during a given period from Singapore only a single ship flew the American flag.

What are we going to do about it?

SUPERHEATING VS. COMPOUNDING.

IT has long been recognized that the steam locomotive is a most extravagant user of fuel, particularly if its performance is compared with that of stationary land and marine engines. The best plants of the two latter types have reduced the consumption of fuel to one and a quarter, and in some cases, one pound of coal per horse-power per hour, whereas the locomotive uses from five to ten pounds. This is no indication that the design and handling of the locomotive are at fault. It is rather the outcome of the restricted conditions under which the locomotive boiler and engine plant have to do their extremely arduous work.

In view of the steadily decreasing consumption of marine and stationary engines, due largely to the introduction of multiple-expansion, it was inevitable that an attempt should be made to apply the compound principle to the locomotive. During the past twenty years a large amount of experimental work has been done in this direction, but although in many cases decided economies have resulted, there have been so many offsetting expenses, such as the increased first cost and the greater cost of maintenance, to say nothing of the acknowledged unsuitability of the compound for certain classes of locomotive work, that the compound locomotive has failed to establish the quick popularity which was expected. Some roads, indeed, which so far adopted the principle as to build a large number of compounds, have been so dissatisfied with the results that they have dismantled or changed their compounds and gone back to the simple engine.

Of late years, however, thanks mainly to the investigations of German engineers, there has been introduced into locomotive practice a system which has realized economies equal to those which were expected of compounding, and even exceeded them. We refer to the practice of superheating the steam on its way from the boiler to the cylinder. Not only does superheat render possible large economies, but it has the advantage that these economies can be realized in the simple high-pressure engine; and thus, not only is the first cost and subsequent cost of operation of the compound engine avoided, but it is possible by comparatively inexpensive alterations or additions to the boiler, to apply superheat to the existing simple high-pressure engines.

One of the most valuable contributions to the literature on this subject is found in a report to the recent International Railway Congress Association, which deals in a luminous way with the subject of superheated steam in locomotives, as developed in France, Belgium, Italy and other European countries. It is significant that those railroads which have used superheated steam are extending its application, and that not one of them has abandoned its experimental work.

The reduction in the consumption of water and fuel has been found to be directly proportional to the amount of superheat used, and it is greatest when the locomotive is doing heavy and continuous work. The saving of fuel in the case of simple engines has reached the high figures of 29.64 per cent of coal, and 28.67 per cent of water, these results being obtained on the Belgium State Railroad. It has been found that there is no economy shown until the superheat is at least from about 55 deg. to 70 deg. F. Single expansion locomotives using superheat have been tried in exactly the same service and under the same conditions as single expansion locomotives using saturated steam. In these tests the same trains were hauled over the same tracks, and the amount of fuel consumed was carefully weighed. The results showed that the superheated steam locomotives achieved a total saving of from 18.20 to 22 per cent. It was found that the temperature of the superheated steam should not exceed about 660 deg. F., and 608 deg. F. gave, in simple locomotives, the highest efficiency with the least deterioration of the engines.

The best economies were realized on level roads where the locomotives could make long runs at a uniform rate of speed. Superheat also showed to great advantage on long and steep up-grades. On the other hand, the advantages were not nearly so marked on lines with broken or successive up and down gradients, or on runs made up of a number of short runs with frequent stops.

Although superheat might seem to have made compounding unnecessary, it should be mentioned that the application of superheat to existing compounds results in a marked economy, the four-cylinder express compounds of the French Western Railway realizing from 13 to 14 per cent economy by the addition of superheat; the compound express locomotives on the Belgium State Railway show 12.3 per cent advantage, while from 7.3 to 10 per cent economy is shown on the Italian state railways. It is interesting to learn from the report that the four-cylinder express compound using superheated steam does not show any decided gain over a simple four-cylinder single expansion locomotive using superheat.

The incidental advantages mentioned in the report are that the saving of water renders it necessary to turn on the feed less frequently and makes it possible for a locomotive to run a greater distance without having recourse to the water tank. Since superheat is more economical at the lower pressures, the wear and tear on the boiler, under these lower pressures, is less, and there is a consequent reduction of maintenance expenses. On the other hand, the use of superheat necessitates greater care in the packing of the stuffing boxes and the adjustment of the valves and piston packing. This last condition, however, has been easily met in the Continental experiments, and the general introduction of superheat seems to be assured.

A NOVEL EXPERIMENT IN THE INVESTIGATION OF FOREST INFLUENCES.

A LIVELY war of words has raged of late, in both Europe and America, over the question of the influence of forests upon stream-flow, and incidentally the whole subject of the interrelations of forests and climate has been under discussion. The recent International Navigation Congresses at Milan and St. Petersburg have been the battlegrounds of the controversy abroad, and the disastrous floods of the past year in France and Germany have awakened great interest in this subject in the popular mind. In America the Weather Bureau and the Forest Service have clashed over the question of the control of river-stages by forests, and the importance of the forest as a safeguard against floods. A few months ago the Chief of the Weather Bureau made an elaborate report to Congress, the effect of which was to minimize the importance heretofore generally ascribed to forests in this relation. This report led to a somewhat acrimonious discussion in the scientific press among engineers, foresters, and meteorologists.

In reading the literature of this intricate problem one is impressed by the fact that a great deal of theorizing has been done upon a slender basis of facts. The paucity of the available data *ad hoc* is surprising; for although streams have been gaged and rainfall measured for generations, the observations thus far accumulated were mostly taken for the purposes of climatology alone, or of hydrology alone, and it is found exceedingly difficult to apply them to a solution of the problem in question.

The recognition of this fact has led the United States Weather Bureau and the United States Forest Service to undertake jointly a series of investigations designed to supply precisely the data needed. A very complete study of the effects of forest cover upon streamflow, erosion; disposition of silt, etc., as well as their possible meteorological relations—will be carried out on two watersheds of similar topography near Wagon Wheel Gap, Colorado, in the Rio Grande National Forest. The dams and instruments for the measurement of streamflow, together with a complete equipment of meteorological apparatus, will be installed at about 9,500 feet elevation above sea-level. The streams drain an area that extends upward to about 10,500 feet elevation.

It is intended to measure the flow of the two streams for a period of eight or ten years; i. e., long enough to show that with similar forestation the behavior of the two streams is the same. One of the watersheds will then be cleared, and the measurements will be continued for a further period of eight or ten years, so that the effects of denudation may be perfectly determined, by comparing the results of observations in the two tracts.

The instruments and the observers are already on the ground, and this important investigation will proceed without delay.

Kinet, an experienced aeroplanist, met with a fatal accident on July 10th at Brussels. He was attempting to fly from Ghent to Liege in a Farman biplane when his motor failed to work. His machine fell from a height of 300 feet. Kinet received injuries from which he is not expected to recover.

AERONAUTICS.

Following the aviation meet at Atlantic City last month, Asbury Park will hold a similar event from the 10th to the 20th instant.

Aviator Chas. K. Hamilton is building a new biplane with which he expects to compete in all the big events this fall. The machine is to be engined with a new 8-cylinder V-type motor of 100 horse-power and 270 pounds weight, built by Walter Christie.

A prize of $10,000 has been offered by the Boston Globe for the fastest flight of 24¾ miles from Soldier's Field, Brighton, in Boston, around the lighthouse in Boston harbor and back. This prize is to be competed for during the Harvard Aeronautical Society's aviation meet to be held at Brighton from September 3rd to 13th. The society has imported a Roe triplane from England for this meet, and all the prominent American aviators will be on hand.

After a month's stay in Canada, during which time he made many splendid flights, Count Jacques de Lesseps returned to France via New York last Thursday. Count de Lesseps made over 50 flights in his two Blériot monoplanes at the Toronto and Montreal meets, three of which were daring flights above one or the other of these two cities lasting a half hour or more and accomplished at an elevation of 1,000 to 2,000 feet. His flights have given all who witnessed them an excellent idea of the practicability of the monoplane type of aeroplane as a vehicle for the transport of the individual. He himself believes that it will soon be used by the ranch owners of our western states for getting about their ranches, visiting those of their neighbors, and traveling to the nearest town.

Mr. Clifford B. Harmon, America's chief amateur aviator, has recently received a new 50 horse-power Gnome revolving-cylinder motor, and installed it in his Farman biplane. On the 21st ultimo he made several circuits of the field at Mineola with the new engine, but as the aeroplane was somewhat out of balance, he attempted no long flights. Last week he rectified the trouble and flew as well as usual. He has cabled Paulhan to secure for him a racing Blériot monoplane with a 14-cylinder 100 horse-power Gnome motor, and has also invited the French aviator to come here and fly in the $30,000 prize cross-country race to St. Louis which starts on the 15th.

Considerable progress is being made at Mineola, L. I., by the members of the Aeronautical Society. Fully a dozen aeroplanes are housed in the society's large shed (which has recently been enlarged) and in tents pitched nearby. Most of the machines are of the biplane type, but there are also several monoplanes. The latest machine of the latter type is that of Dr. Walden, which resembles the "Demoiselle" of Santos Dumont, the chief difference being that the motor—a 3-cylinder Anzani—is placed back of the aviator with the propeller behind the plane instead of being located on top of the plane with the propeller in front. The machine also has novel stabilizing fins of peculiar shape and arrangement above the plane at each end.

By his wonderful high flight at Atlantic City on July 9th, Walter Brookins broke by a wide margin all previous records of this kind and brought to the Wrights new laurels by showing the splendid "climbing" ability of their biplane. After a steady ascent of 53 minutes in circles, he reached a height, as observed from the ground, of 6,175 feet. His fuel gave out and he was obliged to descend in gliding flight from this tremendous altitude. This he did successfully in 10 minutes at a rapid rate. He was chilled through despite warm clothing. When at his greatest height he lost view of the sea because of the mist, and had difficulty in determining whether he was rising or descending. His flight won him a $5,000 prize, and he broke by 1,236 feet his former record made at Indianapolis and by 1,560 feet Latham's European record. The registering barometer carried showed 6,200 feet.

At Mineola, L. I., last Thursday Capt. Baldwin came near having a bad smash with his biplane owing to his being unable to stop the engine when he alighted. The short-circuiting button of the magneto (which causes it to stop sparking) failed to work properly and the motor kept on running, though at reduced speed. One end of the machine was caught by an attendant, causing it to swing around and just avoid hitting the fence in front of the grand stand. Our aeronautic editor, Mr. Stanley Y. Beach, met with a similar mishap on July 11th, when his monoplane ran off a 30-foot cliff on the shore of Long Island Sound at Stratford, Conn., due to the failure of a knife switch to close properly and to short-circuit the magneto. Fortunately he jumped out of the machine just in time. These accidents show that every aeroplane should be equipped with brakes and that the throttle of the motor should be so set that the latter can be stopped promptly even with the spark on. We understand that Count de Lesseps will not use a magneto for the reason that he believes there is greater liability of failure in stopping the motor by shutting off the spark.

ELECTRICITY.

According to a recent press report, a novel method of amputation has been suggested by Prof. J. A. d'Arsonval of the College of France. He proposes to use electricity for this purpose and by experimenting on animals has proved that he can produce a high temperature with electric current, apparently without pain. After several days the member thus treated falls away, leaving a stump which is perfectly cicatrized.

Few persons realize what an enormous amount of the precious metals and even precious stones such as diamonds, are used in the manufacture of telephone apparatus. We have been informed by the Western Electric Company that in a single year it uses upwards of a ton of platinum for this class of apparatus alone. As platinum costs 30 per cent more than pure gold, it will be evident that this expensive metal would not be used so extensively unless results justified it.

Amateur wireless telegraphers in Chicago are doing their best to prevent interference with commercial systems. The Chicago Wireless Club, which has about one hundred members, has by agreement with the commercial stations, set certain periods of time during the day in which amateurs who have stations of over ½ kilowatt capacity may operate. They are permitted to use their systems for the first fifteen minutes of each hour from 6 to 11 P. M. on week days and all day on Sundays.

The centennial of Mexico's independence will be celebrated on September 15th and 16th by brilliant illuminations throughout the country. The City of Mexico is preparing for a splendid spectacle. The great cathedral and the public buildings will be outlined with colored lights. One hundred thousand electric lights mainly of eight and sixteen candle-power are being installed. The celebration will be made doubly interesting by the fact that the 15th of September is the birthday of President Porfirio Diaz, who on that day will complete his eightieth year.

A novel four dial clock has been installed in the United States Post Office, Custom House, and Court House at Newbern, N. C. The dial, which is 12½ feet in diameter, bears no numerals, but is provided instead with twelve opalescent glass disks fifteen inches in diameter. These show white in the daytime, but are illuminated at night by electric lights and reflectors. Each of the hands is also illuminated by means of a red electric light near the point. In order to provide access to the lamps behind the disks, each dial may be rotated so as to bring the lamps within reach of a window in the tower.

Accidents to children from wagons, automobiles, and street cars have increased to such an alarming extent in Cincinnati, that a campaign has been started to teach children the dangers of playing on the street, and the peril that lies in electric wires. To this end, a booklet has been prepared for use in public schools, which not only recounts the various types of accidents that have occurred in the past, but also cautions the children against many of the careless practices they now indulge in. There are a score of cautions which the teacher is asked to impress upon the pupils, and a number of suggestions as to what a child should do, not only for his own safety, but for that of his mother or sister or playmates.

A pair of storage battery locomotives have been installed at the Lillie Bridge yards of the Metropolitan District Railway in London. These are intended to be used as switching engines about the yard, which is not equipped with the third-rail system. They are also to be used in hauling wrecking trains, and at night for moving ballast trains. Each accumulator weighs about 32 tons, and consists of a battery of 80 cells containing 21 plates each. The battery has a discharge capacity of 179 amperes for eight hours, and for short periods may discharge as much as 800 amperes. The normal potential is from 150 to 155 volts. The motors are arranged to take current from the third rail where this is available.

The remarkable performance of a three-phase, 220-volt induction motor of standard make is described in a recent issue of the Electrical Review and Western Electrician. The motor was placed in a mine at a point where the air was very damp, and water was constantly dripping. Because of the high temperatures prevailing at that spot the motor was not inclosed. The motor was geared to a mine pump. Last winter the mine was flooded, submerging the pump and the motor to a depth of two feet. As it was necessary to continue the operation of the pump, the motor was not shut down, and for two hours it ran without interruption, though completely submerged, until it had actually pumped itself clear of water. The motor suffered no damage, and was stopped only long enough to clean off the dirt and chips around the rotor, after which the bearings were oiled, and it was started again. Since then it has been running steadily for an average of twenty hours a day.

SCIENCE.

Prof. Frank H. Bigelow has resigned from the United States Weather Bureau, with the scientific staff of which he has been connected for the past nineteen years.

The thumb-print system will be used hereafter in the city of Milwaukee, Wisconsin, in paying off city employees. The city treasurer will give each employee a card with his thumb print on one side. The other side is to be blank until the owner of the order calls at the office for his money. Thus the city hopes to prevent forgery.

About 25,000 pounds of frozen egg products were recently confiscated by the Government in Brooklyn by order of the Department of Agriculture. A chemical and bacteriological examination of the eggs showed that each gram of the egg product contained 300,000,000 organisms, some gas-producing, and some of the streptococcus group. The desiccated eggs came from Chicago.

According to the Revista Minera, a Spanish Royal decree has been issued ordering the formation of an Association of Laboratories for the encouragement of scientific investigations and experimental studies. Any laboratory or similar investigation department belonging to the State may form part of the association provided that the necessary authorization be obtained from the responsible department.

Many experiments have been made to determine the toxic power of ordinary or ethyl alcohol, but no systematic experiments have hitherto been made with methyl or wood alcohol. The German physiologist, Mueller, has recently found that methyl alcohol is no more poisonous than ethyl alcohol, to dogs. To man, methyl alcohol is somewhat more poisonous than ethyl alcohol, but pure methyl alcohol is not sufficiently poisonous to cause danger of injury from the vapor of the methyl alcohol used in various industries. The accidents which occur in such cases are caused, not by the methyl alcohol itself, but by the impurities which it contains.

According to W. R. Whitney, the addition of boron or beryllium increases the resistivity of iron to a high degree, at the same time improving its mechanical properties and making a valuable steel for electric transformer sheets. The increased resistance causes, of course, a reduction of the eddy-current losses. The proportion of boron in the high-resistance alloy may vary from about 0.2 per cent to 5 per cent boron, but for most purposes the lower limit of boron content is preferable. The steel should be as free as possible from sulphur, phosphorous, or other ingredients. The effect is ascribed to the fact that a given weight of alloy, containing given percentages of iron and alloying element, will have a higher resistance if the atomic weight of the alloying element is low, as a given percentage of the element introduces a relatively greater number of molecules than the same percentage of an element of higher atomic weight.

A new form of anemometer for recording separately the components of the wind motion in two fixed rectangular directions, such as the north-southerly and the east-westerly, is described by J. T. Morrison in the proceedings of the Royal Society of Edinburgh. The novel feature of this instrument is a sphere, mounted on a horizontal axis, the latter being moved in a horizontal plane by a wind vane so as to lie always parallel with the direction of the wind. The sphere is connected, by suitable gearing, with a wind wheel exposed to the wind, and rotates with it, its rotation corresponding to the total movement of the wind. The latter is analyzed into two components by means of two beveled discs, mounted on vertical axes, and pressing the sphere at their edges, so as to be turned by it with speeds and directions varying according to the position of the sphere. The center of one disc lies east and that of the other north of the center of the sphere. The discs actuate separate pens that trace curves making a continuous record of the two rectangular components of wind-movement.

After many months of discussion and experimenting, the French Government has decided not to adopt aluminium coinage. This is on the recommendation of the Commission of Scientists whom the government appointed to consider the subject. A certain number of aluminium coins were made as a test, but the lightness of the white metal which was one of its chief recommendations has condemned it. A five-centime piece (one cent) made of aluminium weighed only 1.9 grammes, as against 5 grammes in bronze, and it is thought that a coin so light would slip through the fingers, especially the rough fingers of a workman. Tests are now to be made of bronze, containing 10 per cent of aluminium, which, if adopted, will reduce the weight by one-half. This combination of metals possesses a fine golden yellow color, and the coins made of it will therefore be perforated so that they may not be mistaken for 20-franc pieces.

A RÖNTGEN-RAY CABINET

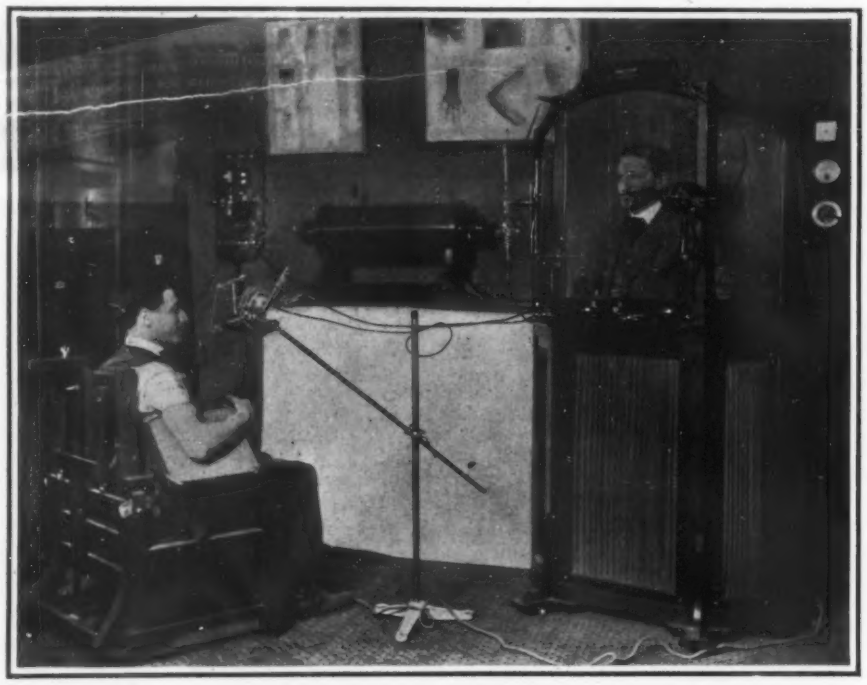
BY FRANCOIS RICHARD.

The increasingly frequent employment of very powerful apparatus for examination and treatment with Röntgen rays, especially for the production of radiographs, has naturally led to the invention of devices for protecting from the influence of the Röntgen rays all of the patient's body except those parts upon which the action of the rays is desired.

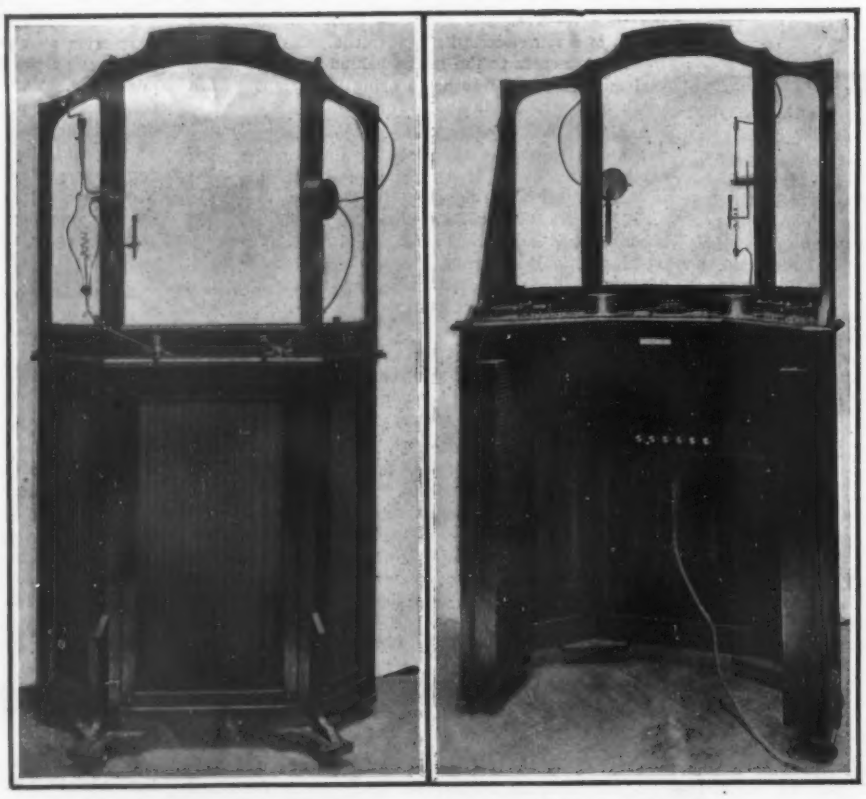
Hitherto, in France, at least, no care has been taken to protect the physician. The Röntgen ray cabinet, which is here described and illustrated, has been devised to supply this deficiency.

The cabinet is constructed of mahogany and glass and presents the appearance of an ornamental screen. The glass which forms its upper portion contains a large proportion of lead and arrests all injurious radiations, while its transparency permits the physician stationed behind it to observe every detail of the operation. The other parts of the cabinet are lined with sheet lead, which is impermeable to Röntgen rays.

To the front of the cabinet are attached the milliamperemeter, by which the strength of the current which traverses the Crookes tube is measured, the valve which regulates the flow of the current, and the spintermeter (operated from behind the screen) by which the length of spark equivalent to the tube discharge is measured. Within, or behind the cabinet are the condenser, the rheostat, and the switchboard. The switchboard is connected with the induction coil and the turbine interrupter, which are outside of and detached from the cabinet, by means of a long and flexible cable, containing six conductors, so that the cabinet can be placed in any position that may be found most advantageous for observing the working of the apparatus and the effect of the rays on the patient.



The cabinet in operation



Front or outside view. Back or inside view.

A RÖNTGEN RAY CABINET.

Dew Ponds.

It is said that when Jack and Jill went "up the hill" on their ill-starred water quest, their destination was a dew-pond on a summit of the English Downs. The hydrology of the Down country is as topsy-turvy as the name "down" itself; for a down is an upland, and the downs of the south of England afford their inhabitants a bountiful supply of water even when the intervening vales are parched with drought. Hence one sees here the singular spectacle of cattle being driven to the hilltops to be watered, and carts being sent uphill to procure water for the dwellings in the valleys below.

What is a dew-pond? The word is only to be found in the two newest dictionaries—the New International and the Century Supplement, both published this year—though it has been used locally for at least a hundred years, and perhaps very much longer.

In the first place, dew-ponds are all artificial, though the construction of the oldest of them dates back to a prehistoric era. The art of making them has not been lost, for Messrs. Hubbard, in their "Neolithic Dew-Ponds and Cattleways," tell us that there is still at least one wandering gang of men who will construct for the modern farmer a dew-pond that will contain more water during the heat of summer than during the winter rains.

The artificial ponds on the downs are not all dew-ponds. Many of them are simply storage reservoirs for water received by surface drainage; but the true dew-pond receives its water directly from the air—whether chiefly in the form of rain, mist, or otherwise is a question still unsettled.

An essential feature of the dew-pond is its impervious bottom, enabling it to retain all the water it gathers, except what is lost by evaporation, drunk by cattle, or withdrawn by man. The mode of construction varies in some details. The bottom commonly consists of a layer of puddled chalk or clay, over which is strewn a layer of rubble to prevent perforation by the hoofs of animals. A layer of straw is often added, above or below the chalk or clay. The ponds may measure from 30 to 70 feet across, and the depth of water does not exceed three or four feet.

The theory that these ponds are fed by dew, in the ordinary sense of the word—i. e., by the direct condensation of the invisible moisture of the air—is supported by little more than the popular tradition implied by their name, and even tradition is not unanimous on the subject. Rain of course supplies much of their water, and may supply all of it, as is maintained by Mr. Herbert Gibson in the current number of Symons's Meteorological Magazine, who bases his opinion on observations made by H. P. Slade many years ago.

On the other hand, Mr. Edward A. Martin, who has been making an extensive series of observations in the downland of Sussex, with the aid of a Royal Society government grant, believes that he has found an important source of the water supply in the frequent mists that drift in from the sea. He is the author of several memoirs on this subject, from the latest of which, published in the Geographical Journal of August, 1909, we quote the following:

"In regard to the question as to how far fog or mist goes toward replenishing ponds, it is well to bear in mind that the term 'mist-pond' has been found in use in the neighborhood of Worms Heath, in Surrey, in Kent, and in Wiltshire, as recorded by Messrs. Johnson and Wright. Mr. Johnson also records, in his 'Folk-Memory,' on Mr. T. W. Shore's authority, that the term 'cloud-ponds' is used in some parts of Hampshire. I am also informed that some of the older inhabitants of Hampstead knew certain ponds on the heath by the name of 'fog-ponds.' . . . Every one acquainted with the Sussex downs must be familiar with the sea-fogs which sweep inland from the south. One's clothing quickly becomes covered with a deposit of dew-like beads, and it seems to me that the warmth of pond water will in no way act against the deposition of mist. . . . I am informed that on some of the downs in West Sussex the highest parts are chosen now for pond construction, as being more exposed to the south-west moisture-laden winds. Dew would not be deposited, of course, if the air were in rapid motion, but fog brought in from the sea would remain in spite of the wind, provided the temperature were sufficiently low, the seemingly stationary fog being in reality continued condensation of moisture."

So the name "dew-pond" is a misnomer; but, as Dr. Hugh Robert Mill has recently remarked, it would be a pity if this picturesque word should vanish from the language.

According to the Ironmonger, Italy at present consumes about 50,000 tons of tin-plates per annum, three-fourths of which is made in three tin-plate mills at Piombino, Darfo, and Savano, respectively, while the remaining 13,000 tons are imported from Britain. The conversion of this plate into tins leads to the production of 10,000 tons of scrap, the bulk of which is treated in several detinning works, where about 8,700 tons of iron and 210 tons of tin are recovered. The general practice is to treat the scrap in iron tanks, insulated from the ground, and fitted with pumps for insuring the circulation of the electrolyte. The six anodes in each tank consist of iron crates filled with the scrap, the seven cathodes being of iron plate. The current consumption is 1,000 to 1,200 amperes, and the capacity per tank is about 16 hundredweight of scrap, per day. The spongy tin is scraped off the cathodes, washed, pressed into cakes, and stored under water to prevent oxidation. The cakes are melted in a bismuth furnace, the oxidized portions being fined in a reverberatory furnace. The iron recovered is very pure.

MARINE PROPULSION WITH TURBO-TRANSFORMERS

BY WALTER LANGFORD

A very interesting solution of the problem of marine turbine propulsion has been worked out and applied experimentally by Dr. H. Foettinger and the Vulcan Works of Stettin, Germany.

It is well-known that the number of revolutions at which the operation of a turbine shows the greatest efficiency and economy, is considerably greater than the number of revolutions at which a ship's propeller is most efficient. Hence when a turbine is used for marine propulsion, it is necessary either to compromise by adopting an intermediate speed at which neither the engine nor the propeller operates under conditions of greatest efficiency, or to interpose a speed reducing gear between the turbine and the propeller shaft. The construction of a satisfactory speed reducing gear adapted to the requirements of ship propulsion has offered unexpected difficulties.

Dr. Foettinger's speed reducing gear consists of a rotary pump driven direct by the turbine and combined in one structure with a water wheel secured upon the propeller shaft. The water circulates in a closed path formed by the pump, the water wheel and the stationary channels interposed between the pump and the water wheel. This speed-reducing gear or hydraulic transmission device is called a transformer, and in conjunction with its driving turbine constitutes the turbo-transformer.

For this new drive, Dr. Foettinger claims not only an efficiency ranging from 70 per cent to 85 per cent and generally exceeding 80 per cent, but further the advantage of easy reversibility and of a comparatively small reduction of efficiency when the ship is steaming at cruising speed.

Various types of transformers have been designed in accordance with the principles explained above. In some cases intermediate wheels have been placed in the path of the water between the pump and the wheel carried by the propeller shaft, so as to effect the speed reduction in two or more stages. Arrangements of great simplicity have been devised for reversing the propeller while the turbine continues to rotate in the same direction, and altering the speed-reduction ratio.

The illustrations accompanying this article show in Figs. 1 and 2 the general arrangement of the turbo-transformer in a boat which served for experimental purposes. *A* indicates the steam turbine; the covered admission pipe and the wide exhaust pipe are clearly visible in Fig. 2, also the operating mechanism of the throttle valve. *B* designates the transformer connected with the screw propeller whose shaft is in line with that of the turbine. The turbine developed 400 effective horsepower, and the speed reduction ratio was 1750 to 320.

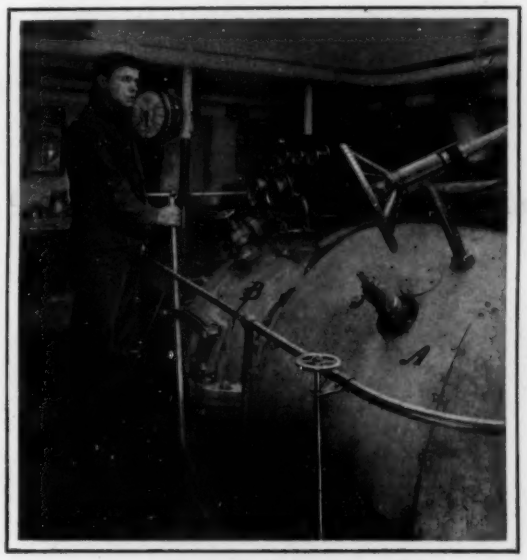


Fig. 1—View of Engine Room.

A, turbine; *B*, transformer.

In Fig. 3, *A* is the shaft secured to and driven direct by the turbine shaft. The shaft *A* carries a rotary pump which at its periphery throws water into stationery channels provided in the guide *C* and from these channels the water is discharged against the blades or buckets of the water wheel *B* which is fast upon the propeller shaft designated by the same letter and provided with a thrust-bearing *D*. The water returns from *B* to *A*. The cut illustrates a demonstration model.

A slightly different construction of the transformer is shown in Figs. 4 and 5, representing another demonstration model. The shaft *A*, driven direct by the turbine, carries the rotary pump *A* which takes in water at the center and discharges it at the periphery, by means of curved blades which throw the water against buckets or blades of the water wheel *B* which rotates in the same direction as the pump *A*, as indicated by the the arrows, and is fast upon the propeller shaft *b*. After doing work in the wheel *B*, the water travels outwardly through channels formed by the stationary guides *C* and reaches the spaces between the receiving ends of guide ribs provided on the water wheel *B*. These ribs are somewhat U-shaped, with one member of the U much shorter than the other, each rib being disposed in a radial plane. The short receiving ends shown in Fig. 4 are on the front side of the transformer, that is, the side nearest the turbine. The water by flowing between the U shaped ribs, is transferred from the front of the transformer to the rear (Fig. 5) and then flows inward between the said ribs, finally reaching the axial suction chamber of the pump which is also visible in Fig. 4.

In each construction, the water travels in a continuous path which is comparatively short. This insures a construction remarkable for its simplicity, compactness, and light weight; furthermore, losses of energy by friction and whirling are reduced considerably, and any velo-

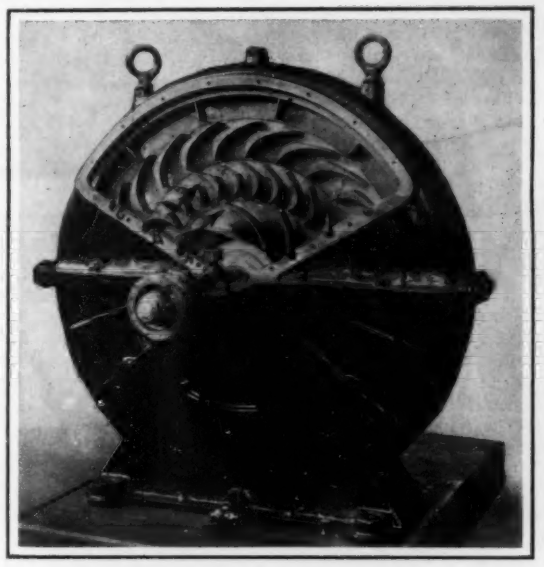


Fig. 4.—Front view of demonstration model of another type, with part of casing removed.

a, drive shaft; *A*, pump; *B*, pump: *C*, stationary member with guide channels.

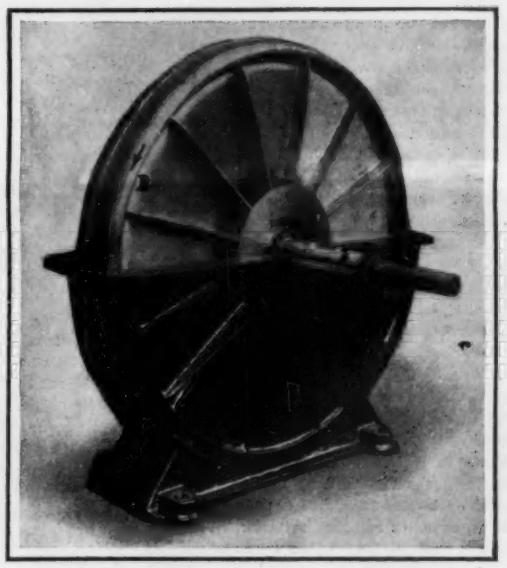


Fig. 5.—Rear view of model Fig. 4, with upper half of casing removed, showing propeller shaft *b* and water wheel *B* with radial ribs to return water to pump.

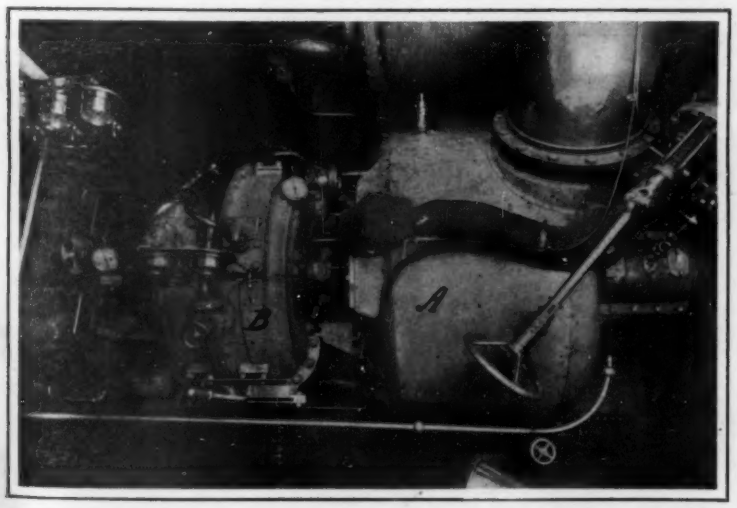


Fig. 2—Top view of engine room showing turbine *A* and transformer *B*.

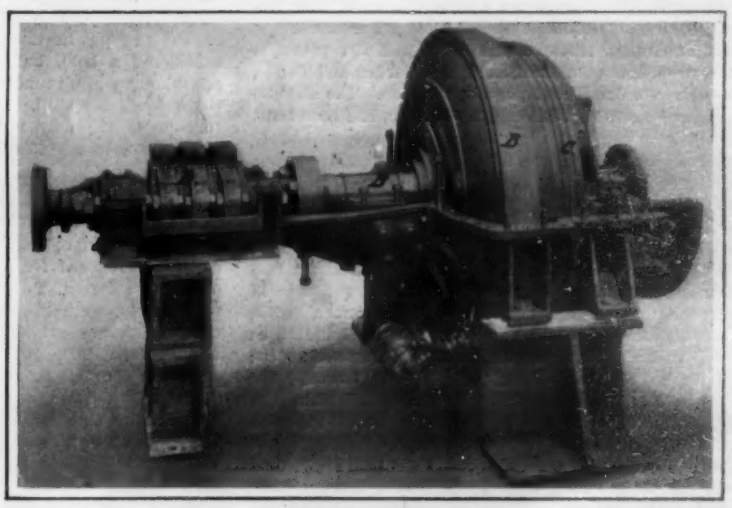


Fig. 3.—Demonstration model of one type of transformer, with upper part of casing removed.

A, drive shaft of pump; *B*, propeller shaft and water wheel; *C*, stationary member with guide channels; *D*, thrust bearing for propeller shaft.

city which the water retains at its return to the pump, diminishes the energy required for the operation of the pump and thus contributes to the attainment of a high efficiency. The production of a vacuum at certain places (cavitation) and corrosion which is commonly attributed to such local vacuum, are avoided almost entirely with the turbo-transformer, without any special provision. Still, if increased security in this direction is desired, the circulatory path may be connected with a stand pipe or with other means for insuring the preservation of a constant pressure within the apparatus.

A MAMMOTH OFFICE BUILDING DISSECTED.

We are much more apt to be impressed by a building that exceeds all others in point of height rather than bulk, mainly because our eyes are constructed to take in only the superficies of an object and hence give us but an inadequate conception of its cubical content. For instance, it is not half so sensational to state that the coal consumed by a transatlantic liner in a single trip would occupy a bin 60 ft. square and 50 ft. deep as to state that a train over a mile long would be required to cart this amount of coal from the mines to the vessel. Again the great pyramid of Cheops, which is the bulkiest monument built by man is frequently used as a unit by which to show the enormity of our annual crops, our output of coal, the production of iron and the like, but frequently this results in filling the reader with astonishment at the hugeness of the pyramid itself rather than impressing him with the enormous bulk of the product compared therewith.

Public interest in large buildings has been so occupied with the loftiness of the Metropolitan and Singer towers in recent years that other buildings, much larger, when their three dimensions are considered, have received practically no attention. For example the City Investing Company's building, though many times bulkier than the towers just referred to, has been almost completely overshadowed by the neighboring Singer tower because the latter reaches up a hundred odd feet higher.

However, the tower type of building has about reached its limit of height, not on account of any structural difficulties, but because the revenue from offices hardly provides sufficient return on the original investment. For this reason, the sky-scrapers of the future will have to be wide and deep as well as tall. Our sky piercing towers have established the records but the real work of raising the sky line of New York will be done by the large buildings that are growing up to these record heights. It is only fair that these huge, though not so tall buildings, should receive recognition.

The largest office building now in course of construction is an annex to the Whitehall Building on Battery Place. The original structure is only twenty stories high, but the Annex is to consist of thirty-one stories, and will rise to a height of 415 feet from the curb. While this is about 75 feet less than the extreme height of the City Investing Building, it represents a larger rental capacity when combined with the old building, the office space in the two being 550,000 square feet, or more than in any other building in the world. The Annex is built on a plot of 51,515 square feet, and the total cubical capacity of the building, exclusive of the foundations, will be 11,000,000 cubic feet.

Before commencing the actual construction of the building, it was necessary to excavate 17,000 cubic yards of earth. This is equivalent to digging a narrow trench 18 feet wide and 6 feet deep all the way from the Battery to Madison Square.

In order to convey an adequate idea of the tremendous proportions of this building, our artist has dissected the structure and assembled the principle materials about the Madison Square Garden and Tower, as shown on the front page illustration. The structural steel work, representing 14,000 tons, has been built up into a single girder of standard proportions 19 feet square, the metal being correspondingly heavy, and this extends to a height of 308 feet. The girder compares favorably with the Madison Square Tower. In constructing the walls of the building seven and a half million common brick will be used, and these, if built up into the form of a brick of standard proportions, would completely overshadow Madison Square Garden. In addition to the common brick, 900,000 face brick will be required in the building as well as 3,000 tons of ornamental terra cotta and the latter molded into a single capital would occupy the dimensions given in the illustration. Within the building there will be 450,000 square feet of partition tile and 120,000 square feet of column covering. 45,000 barrels of Portland cement will be used. The cinder fill for the floors will be about half a million cubic feet, which, if put into a rural sidewalk of standard dimensions would reach nearly all the way from New York to Philadelphia. It is astonishing how much glass is required in the building. If made into a single sheet it would cover 60,000 square feet, or more than an acre and a half. Even such a thing as the window weights is an enormous item, as will be evidenced by comparing the huge window weight in the illustration with the man shown at the right hand side. While modern office buildings are constructed of fire proof materials, a certain amount of wood is absolutely necessary. For the floors alone of the Whitehall Annex, 800,000 board feet of yellow pine will be required, while for the base molding, 80,000 feet will be used.

To heat the building, 65,000 sq. feet of radiator surface will be furnished and if a single radiator were made to provide this amount of radiating surface it would rise almost to a level with the roof of the Madison Square Garden. The boiler equipment of the building will consist of 21,000 horse-power, and the engines of 2,000 horse-power. The combined candle-power of the electric lamps will be 190,000 and there will be over 3,000 electric fixtures, with 65 miles of conduits and wiring. Ten miles of plumbing will be necessary and 20 miles of steam pipes. While these are only a few of the items required in the construction and equipment of the building they suffice to show that a large structure may possess a great deal of interest quite apart from its height.

How Rolls was Killed.

It will probably never be quite clear in what way Rolls was killed, but there can be no doubt that in this case, as in several recent accidents, the immediate cause of the disaster was the failure of the machine itself. It is, of course, possible—and, in fact, probable—that this failure was caused by the aviator trying to make a very sudden change in his course in order to alight in the exact spot desired, and that this involved putting over the tail plane to such an angle as to bring a greater strain on it than it was intended to bear. What is certain is that the framing of the tail broke, the machine became uncontrollable, and fell on its head. The rudder was found attached to the framework after the accident. The accident in any case emphasizes the lesson that the factor of safety in the various parts of aeroplanes requires a great deal more consideration than it always gets. It is always possible that aviators will put either their elevators or rudders hard over, and there may in practical flight be cases where this is absolutely necessary. Now no one would consider the steering gear of a boat or motor car satisfactory if simply putting it hard over when in motion caused it to break, and the reliability of these parts in aeroplanes must be brought up to that of other machines. It may be objected that this would cause extra weight, but it would be better for the machine to be slightly heavier and safe.

That it would be quite possible to make the machine heavier without preventing its flight is evident from the fact that flights have been made with a passenger, and, in fact, sometimes with more than one passenger. It is, however, true that giving the parts a larger factor of safety might reduce the weight available for engine power or fuel, and consequently interfere with "records," and therefore competitions in which making records is the principal point may not be altogether good for practical progress. If one could have a "reliability trial" on the lines of the motor car trial, it would probably do much more good.

The death of Mr. Rolls will be a very great loss to English aviation. He was one of the pioneers in motoring, driving for some years as an amateur. Aviation was, however, taken up entirely as a sport, and not, as in many cases, as a means of making money, and there can be no doubt of the value of such men in the progress of aviation. It was really the enthusiastic amateur who developed the motor-car, as he found its defects, and had no trade interests to prevent his saying what he thought. Mr. Rolls was generally considered a bold, but not a rash, aviator, and no one who saw him rounding the marks at Bournemouth could doubt his skill. It will be recollected by most that he is the only man to have made the double journey across the Channel.—Engineering.

The Current Supplement.

In the beginning of 1908, the South African Chamber of Mines in co-operation with the Transvaal Government, arranged for a practical trial of small rock drills for stoping. Two prizes of £4,000 and £1,000, respectively, were offered. The results of this year's competition are published in the opening article of the current SUPPLEMENT No. 1805. An excellent article is one entitled Superheating at Sea. Mr. Harrington Emerson arraigns Our Inefficient Industrial Organization and points out how it can be improved by the adoption of a "staff" as in the army. Some interesting novelties and inventions are described and illustrated. The Paris correspondent of the SCENTIFIC AMERICAN writes on The Radioscope, an instrument devised for use in making measurements of radio-activity of various substances. The summary of Sir J. J. Thomson, F.R.S., on Light and Electromagnetism is continued. Impulse and Reaction Turbine Systems are critically analyzed.

A Universal Differential Pressure Chamber.

BY JOHN B. HUBER, A.M., M.D.

There is now no region of the human body sacred from the surgeon's knife. No day passes in any hospital of fair dimensions that the abdominal cavity is not invaded. Who, several decades ago, dared venture upon entering the cranium? Yet to-day this is done frequently; brain tissue is relieved of pressure by depressed fractures, adhesions occasioning epileptic seizures are separated, cysts are evacuated, cerebral abscesses are drained, blood clots are removed not only from the surface of the cerebrum after injury, but also from the most deep-seated and vital tissues, as in apoplexy.

Until very recently, however, the surgeon has paid the thorax deep respect—that cage which imprisons the lungs, the pleura, the heart, and the great vessels; because, while the cerebrum and abdomen contain organs not immediately essential to existence, we should die almost instantly if the heart and the lungs (especially the latter) are put out of action, and because the resilient and elastic lung tissue tends to collapse, on opening the thoracic cavity, under the atmospheric pressure of fifteen pounds to the square inch, to which the surface of our bodies is subjected.

Before 1904, the thorax had indeed been entered, but not safely, unless inflammatory adhesions between the pulmonal and costal pleuræ protected the collapsible lung tissue against the ordinary atmospheric pressure. But such operations were not justifiable, except when the patient's case was desperate. The surgeon must operate within the thorax as safely as anywhere else within the economy; besides the possibility of an immediately fatal issue, the serious disease, acute pneumothorax, must be feared from such an operation.

In laboratory work on animals a cannular or an inhalation tube has been tied in the incised windpipe, through which air has been rhythmically forced by bellows, and by which means artificial respiration has been maintained as long as needed; but such devices were not applicable for human beings.

So surgeons have recognized that such operations as thoracotomy and pneumectomy cannot be done with impunity without the aid of differential air pressure. Much experimentation had been done to this end, with the result that both the lungs and the esophagus may now be safely invaded. The heart may be exposed to view, the pericardium opened and the myocardium incised. All this is not the easiest thing in the world; nevertheless, the skilled surgeon may now proceed with confidence upon operation most hazardous a few year since.

Among a number of devoted physicians who experimented in differential pressure surgical work, Brauer and Sauerbruch, in Europe, established fundamental principles. The result was that in 1904 there were operating chambers in use in Europe. Brauer's apparatus is a single positive pressure chamber akin to that presently to be described. That of Sauerbruch is a negative pressure chamber, the patient's head being outside of it in the ordinary atmosphere, his body being in the chamber. As in all pioneer work, they were open to various objections. They were made of metal; voices reverberated in them; surgeon and anesthetizer were separated by a solid wall; the noise made telephoning impossible; the operator could not see his patient's face; there was not sufficient room; there was no provision for breakdown of power; there was negative pressure only, or positive pressure only.

Up to the spring of 1908 the existing apparatus was of two types; one working from atmospheric pressure downward, negative pressure; the other from atmospheric pressure upward, positive pressure. There was none working both ways. Wherefore Dr. Willy Meyer of New York city, and his brother, Mr. Julius Meyer, an engineer, built a double chamber for use in positive and negative differential pressure. It was in this chamber that I saw the whole left lung of a dog removed, *cito, tute et jucunde*, as our medical forebears used to put it. A description of this chamber follows:*

There is an outer negative pressure chamber (the operating room) within which is a positive pressure chamber (the anesthetizer's room). It is thus possible to operate under either negative or positive differential pressure; under a combination of the two; or from one to the other in the same operation.

The advantages of combining two chambers to form one apparatus are: The operating table remains fixed under whatever pressure the operation is done; and there is avoided the moving of the table from inside to outside necessary with the European tables, should it be considered feasible to change the pressure from positive to negative, or *vice versa*. Moreover, in this Meyer chamber there is ample space for the surgeon and his assistants and nurses, arranged for by the projecting head box, in which there is an aperture closed by a rubber collar, adaptable to the size of the

(*Continued on page 113.*)

* Based on Dr. Willy Meyer's paper, "Pneumectomy, with the Aid of Differential Air Pressure," in the Journal of the American Medical Association, December 11th, 1909.

Correspondence.

TYPE OF MONOPLANE SHOWING GREATEST "ASPECT RATIO."

To the Editor of the SCIENTIFIC AMERICAN:

The article appearing in the SCIENTIFIC AMERICAN SUPPLEMENT of May 7th, 1910, entitled "Table of Aeroplanes at Olympia" (some observations on the theories of flight) should prove of particular interest to the actual builder of flying machines as well as to the systematic student of aerodynamics. Only comparisons of dimensions, angles, areas, screws power plants, etc., of the different machines will lead to more definite knowledge of mechanical flight, with more precise results in consequence.

Under the heading "Aspect Ratio" in said article some statements are made to which exception must be taken, and it would probably interest your readers to know that monoplanes can be built of the same and even larger "aspect ratio" than any biplane or triplane ever constructed, combining at the same time great strength with extreme lightness, comparatively speaking. The monoplane in mind weighs only 1150 pounds, built entirely of aluminium, has an area in the two transverse planes of 600 square feet, with an aspect ratio of 8.33, i. e., the span of each pair is 50 feet with a plane depth of 6 feet. There is additional active plane surface, however, in the upper hood of the cylindrical portion of the support of nearly 400 square feet. This cylindrical portion without struts weighs 98 pounds; it has a diameter of 8 feet 3 inches by a length of 24 feet. The upper, or transverse, planes are bodily adjustable with relation to the support. From the balancing rods clusters of German piano wire lead to the upper planes and continue from the top to the center of the cradle or main truss, but all the ribs and the planes are trussed separately in the four directions. A careful examination of the photographs under a magnifying glass will easily disclose the method of trussing, which is so effective that a weight of 350 pounds, suspended from each extremity of a pair of planes, showed no undue strain or displacement. You will observe that wherever a wire is crossed by another wire, thin steel plates lock the intersections, so that the whole machine is absolutely rigid, as every wire is under proper tension without the use of turnbuckles or other devices; and each wire meets its counterpart in a circle. These planes move laterally to the extent of 25 degrees, but can be locked in any position as well as be controlled by the steering wheel at the will of the operator, and serve to steer to the left or right; but the principal function of these pivoted planes, as will be seen, is to preserve an automatic equilibrium. The balancing rods, instead of being loaded down with heavy weights, are checked by heavy steel double springs, as shown on the left steering wheel. Sudden gusts of side winds are also taken up by these springs. Both pairs of planes work in perfect, rigid unison; each pair of planes is trussed forward substantially to a swivel to meet the head resistance in flight.

The vertical rudder, as shown in the photographs, is entirely superfluous and serves only for experimental purposes, and is taken off for actual flights. The gasoline tanks are on each side of the machine, and hold 5 gallons each, but in flying trim are replaced by two larger ones of 14 gallons capacity each.

The horizontal or lifting planes are in three sections, one on each side, projecting with a total area of 48 square feet, and controlled by the right steering wheel. The propeller is a skeleton frame cast in aluminium, covered with sheet aluminium, trussed and ribbed, 8 feet in diameter, with a pitch of 12 feet, and absolutely balanced. The widest section is 32 inches, running on Hess-Bright ball bearings, and weighs complete 52 pounds. On the electric tester it delivers a thrust of 750 pounds at a speed of 1000 R.P.M., with a "collar" around the propeller, requiring 64 horse-power to drive it. This thrust has not as yet been made use of in experimental flights, but attempts will be made shortly to turn on full power and see what happens.

The second smaller pair of blades observable are of special interest. They are only 4 feet in diameter, and taper toward their periphery and overlap the axis and fill in, in a way, the inner space of the large propeller. This 4-foot propeller has a much larger pitch, and is capable of moving in either direction, and at the same or various speeds (higher or lower). The reasons for that are obvious; the delivery of air is made quite uniform, i. e., the air moves from the helix disk at the same rate of speed all over, the stream lines are straight and do not churn the air, and therefore no eddies are produced. This combination propeller in an inclosure pulls the machine, instead of pushing it, as is the case with an all-round open propeller; no air can escape, and a thoroughly efficient grip on the air is effected. Each complete turn of the propeller disposes of the helical air mass, screwing itself into a new supply, and needless to point out that the inside air moves at a very much higher rate of speed than the outside moving air, in fact quite a perceptible compression takes place.

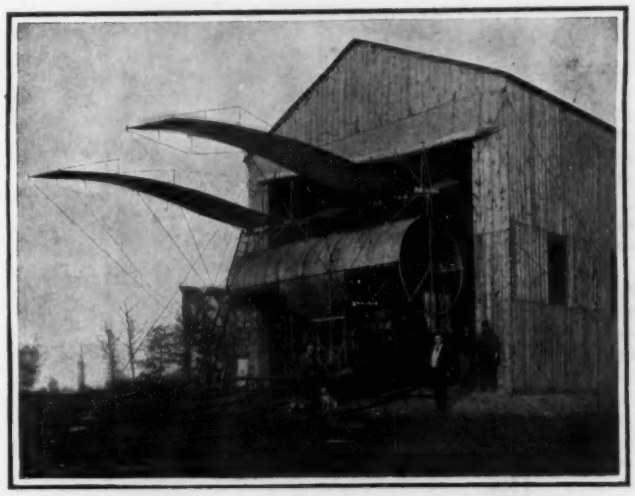
The power plant, in trim for flying, consists of a new and improved revolving motor of 72 horse-power—A.L.A.M. rating—but will develop considerably more, revolving in a vertical plane, similar in arrangement to the gyroscope in Brennan's monorail car. The power is taken from the crank case by a Whitney roller bearing chain up to the propeller shaft. Great things are expected from this motor, which has now been under construction ever since the first part of last January. The previously used revolving motor developed over 80 horse-power, although rated only 56 horse-power—A. L. A. M. rating—but unfortunately it suffered shipwreck the latter part of December on account of some flaws in the cylinders. Besides that, the lubrication proved very inefficient, as centrifugal force prevented the economical use of lubricants. The number of R. P. M. in the new motor has been reduced on the crank case to 800 R. P. M., but 400 R. P. M. are being taken off from an opposite moving device on the motor, and all other errors discovered have been carefully avoided. It will weigh, complete with all accessories, somewhere around 250 pounds. Experience has shown the expediency of adopting a heavier weight motor to secure greater reliability, ever-ready power, and steady delivery, thus assuring continuous running for long periods. Trials with it are expected in the near future. Little can be said for the chassis but what can be seen in the pictures, except that there is room for three passengers besides the operator.

The motor installed at the time when these photographic views were taken, a few weeks ago, is V-shaped, 8 cylinders, air-cooled, developing at times 51 to 52 horse-power, but no sustained flights have been attempted with it. It is employed most of the time on the test box for short-time propeller experiments.

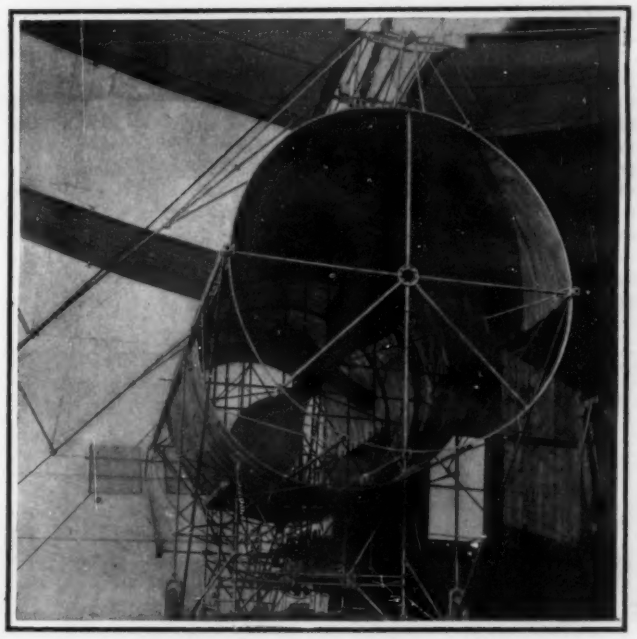
Dimensions of the machine are: Length over all, 29 feet; span, 50 feet; total area, nearly 1,000 square feet; total weight, about 1,150 pounds; aspect ratio, 8.33; horse-power, 72 to 100; propeller, 8 feet diameter. Special features: Pendulum system in combination with gyroscopic action of engine and consequent automatic equilibrium and stability. Propeller in inclosure, metal construction throughout. Four years have been spent in the construction of this machine, and over one thousand aluminium castings have been used, of which about 450 are of different design. The greatest trouble has been encountered in the construction of the pivotal planes and the aluminium propeller.

A. RANDOLPH SILVERSTON.

Milwaukee, Wis.



Three-quarter view of aluminium monoplane built of larger "Aspect Ratio" than any biplane or triplane ever constructed.



End view of aluminium monoplane, showing the combination propeller within the cylinder.

TYPE OF AEROPLANE SHOWING GREATEST "ASPECT RATIO."

A BALANCED ROTARY ENGINE.

To the Editor of the SCIENTIFIC AMERICAN:

It occurred to me, while reading your interesting account of Herrick's rotary engine, that the balancing of the steam pressure on the main shaft might be effected by the use of *two* pistons thereon and *two* valve drums, one on either side of the above shaft. There would in addition be a *turning couple* on the shaft instead of an ordinary single crank movement.

IMMO S. ALLEN.

London, England.

OUR NAVY AS NATIONAL INSURANCE.

To the Editor of the SCIENTIFIC AMERICAN:

I was interested in reading your editorial of May 21st entitled "Our Navy as a National Insurance," and note that you make out the cost for the building and maintenance of the navy to represent a premium of only 4/100 of one per cent of the wealth of the United States.

Granting that this is true, is it not also true that at present 70 per cent of the cost of running the government is required for the army and navy? If the writer remembers correctly, you within the last year illustrated the government expenditures on the front cover of your journal, in which the army and navy were represented by figures of a soldier and a sailor, and towered above all other expenses to the tune of 70 per cent.

Granting again that your former figures were correct, could not this 70 per cent or a part of it be spent to a far better purpose than in an effort to maintain land and sea organizations and machinery for the sake of killing imaginary enemies?

New York city. PALMER H. LANGDON.

"MECHANIPULATE" VS. "MECHANIZE."

To the Editor of the SCIENTIFIC AMERICAN:

Your valuable journal has the true scientific spirit, and will, therefore, be open to adverse criticisms as well as to favorable ones, for we progress through hearing both sides. I presume, therefore, that your invitation to "discuss the merits" of the proposed word, "mechanipulate," includes the discussion of its demerits as well, and to my mind the demerits seem to outweigh its merits. The word "manipulate" is based on two Latin words. To substitute for the Latin "manus," hand, the Greek word "machine" makes not only a "barbarism" of it, but a meaningless barbarism, as if in the English word "handling" we should substitute "machine" for "hand" and create the word "machine-ling."

The word "mechanize" is shorter, is correctly formed from the Greek word "machine," as is "mechanism" or "mechanical," and is now in the dictionaries. Why not use it instead of the new word?

EDWARD P. FOSTER.

Cincinnati, Ohio.

It is announced that the generating plant of the Shawinigan Water and Power Company is to be more than doubled by the addition of a new power-house of 75,000 horse-power to the existing 55,000 horse-power plant, and taking its water supply through pipes from the same forebay. According to the Canadian Electrical News, the distribution system of this company is the largest in Canada, consisting chiefly of 50,000-volt lines of aluminium on wooden poles, and including a 25,000-volt subfluvial cable 7,000 feet long, at Three Rivers, Quebec.

THE NEW PHOTOGRAPHIC APPARATUS OF THE PARIS SCHOOL OF MINES.

BY JACQUES BOYER.

The new photographic apparatus illustrated by the accompanying photographs has just been installed in the School of Mines in Paris. The apparatus was devised by M. Henri Ragot, of the Geological Laboratory of the Sorbonne, for the convenient reproduction, on any desired scale, of both transparent and opaque objects. The apparatus shown in Fig. 1 is used only in a vertical position, for reductions, photographs in natural size and small enlargements. The apparatus shown in Fig. 2 is used for great enlargements and may be placed either vertically or horizontally. In the first apparatus, Fig. 1, the focusing can be effected by moving either the camera or the object-holder. The camera is attached to two vertical rods, which slide on two fixed posts, and is balanced by a counterpoise attached to a cord passing over a pulley. Rapid motion of the camera is effected by loosening the two screws which are seen at the level of the operator's head and moving the camera frame up or down by hand. Slow motion is produced by means of a horizontal wheel connected with a sleeve, which carries a screw thread and engages with a screw on a central fixed rod. By loosening the screw seen on the central rod between the object-holder and the lens, the object-holder can be moved rapidly by hand. Slow motion of the object-holder is effected by tightening the screw and turning the crank shown in the photograph, which by means of bevel gear, turns the central rod, and thus causes a second sleeve, provided with a screw thread and attached to the plate-holder, to rise or descend.

The second apparatus, Fig. 2, is intended for use with microscopic objects, but instead of moving the microscope by means of a rack and pinion, as is usually done in work of this character, focusing is effected by moving the object. The entire apparatus is attached to a rigid beam and may be used in a horizontal or a vertical position. The object-holder rests on a carriage which is movable upon a second and larger carriage. The large carriage is moved rapidly by turning one of the wheels and long rods shown in the photograph, and the smaller carriage is moved slowly, with respect to the large one, by turning the other wheel and rod. A Zeiss planer lens of short focus is used for moderate enlargements and a microscope objective for enlargements on a greater scale. As the pitch of the screw threads which are cut on the long rods is only one-fifth inch, the focusing can be accomplished as easily and accurately as with a rack and pinion. The object is illuminated by a Nernst lamp of 120 candle power, provided with condensing lenses. The part of the object which it is desired to photograph is brought into the field by means of a total reflection prism and a microscope eye-piece attached to the camera, as the great length of the apparatus makes it impossible to move the object by hand while observing its image on the ground glass screen. In addition to these two forms of apparatus, the photographic laboratory of the School of Mines contains an excellent equipment, including two dark rooms provided with all necessary apparatus, and a third and larger dark room containing an enlarging camera and a paper holder for the production of enlarged positives, 30 by 40 centimeters (12 by 16 inches) in size. The camera and the paper holder are mounted on a single frame, which is supported by springs on four light masonry columns. In consequence of this arrangement the tremors produced by the passage of railway trains and trolley cars affect the negative, the lens and the paper simultaneously and to the same degree, and therefore do not diminish the sharpness of the reproduction. Another enlarging camera, sliding on rails, and provided with a lens of 12 inches focus, is used for the reproduction of drawings, measuring 12 by 16 inches. The same apparatus, with the addition of two arc lamps and a series of screens, is employed for instructing the future engineers in the methods of photo-engraving.

Fig. 1.—Vertical Camera.

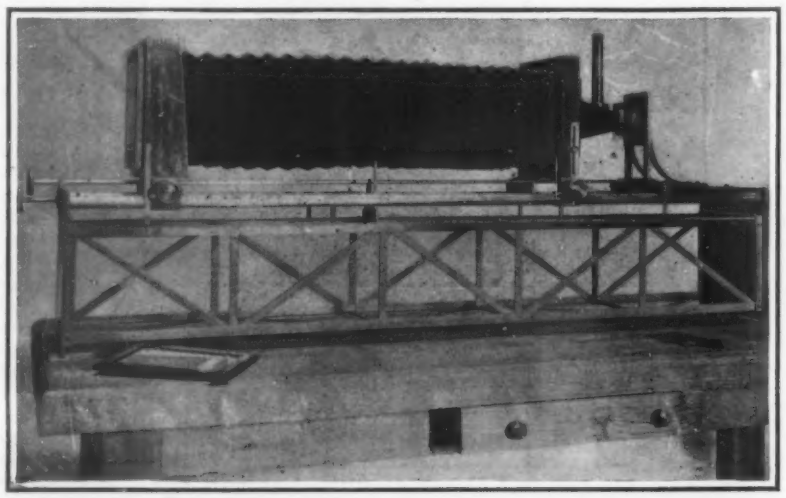


Fig. 2.—Vertical or horizontal camera, for microphotography.

NEW PHOTOGRAPHIC APPARATUS OF THE PARIS SCHOOL OF MINES.

A Submarine Military Tunnel.

BY ARTHUR H. J. KEANE, M.J.I.

The gigantic project of a military submarine tunnel, with a view to effecting (for strategical purposes) a connection between the Swedo-Norwegian and Danish railway services, has been conceived for some time past, but it has now taken tangible form. Of course the intention is to use the tunnel as a means for making one single military unit out of Denmark and Sweden. Mr. Quistgard, a leading engineer, proposed two plans recently in a Scandinavian engineering journal. Of these two plans the one for the formation of a tunnel between Copenhagen and Malmö will probably be accepted, as the other (for a connection between Helsingör and Helsingfors) would be difficult to execute owing to the depths existing in the northern parts of the sea. The tunnel will start from the new Copenhagen railway terminus, now in course of construction, and will then run along a dam and over a bridge to the island of Amager, at the southern extremity of which there will be the mouth of the actual submarine tunnel. The railway will again come to the surface on the small island of Saltholm, the tunnel again commencing at the eastern coast of this island and terminating at Schonen. The total length of the line will be about 36 kilometers, (22 1/3 miles). The tunnels will consist of large tubes, sunk beneath the sea, and the trains will be driven by electricity. There will be a double set of lines, and every care will be taken to insure regular and safe working. What a great saving of time would be effected may be seen from the fact that, when the tunnel is completed, it would be possible to go from Hamburg to Malmö in about three and one-half hours less than is now required. The plan is now being submitted to the Swedish Parliament and, it is asserted, it is certain to be accepted.

The French Government has announced its intention of subjecting flying machines to inspection. Just what is to be accomplished by this inspection it is difficult to foresee. The Wright brothers, as well as the leading French aviators, have expressed the opinion that machines are now built as staunchly as they can be in the present state of aeroplane art.

THE MECHANICAL SIDE OF CONEY ISLAND.—WHERE THE IMAGINATIVE INVENTOR HOLDS SWAY.

One of the first questions which the returning transatlantic traveler is asked by his foreign fellow voyager is, "Where is Coney Island?" and life is made miserable until the tall towers and the revolving Ferris wheels are sighted a short time after leaving Fire Island. At night the scene is a most impressive one, for enough light is being used to illuminate a city of five hundred thousand souls, while the power which is being used in "making the wheels go round" would operate the largest manufacturing plant in the United States, and the daily capacity of the trains and boats would serve to carry all the political conventions of a year.

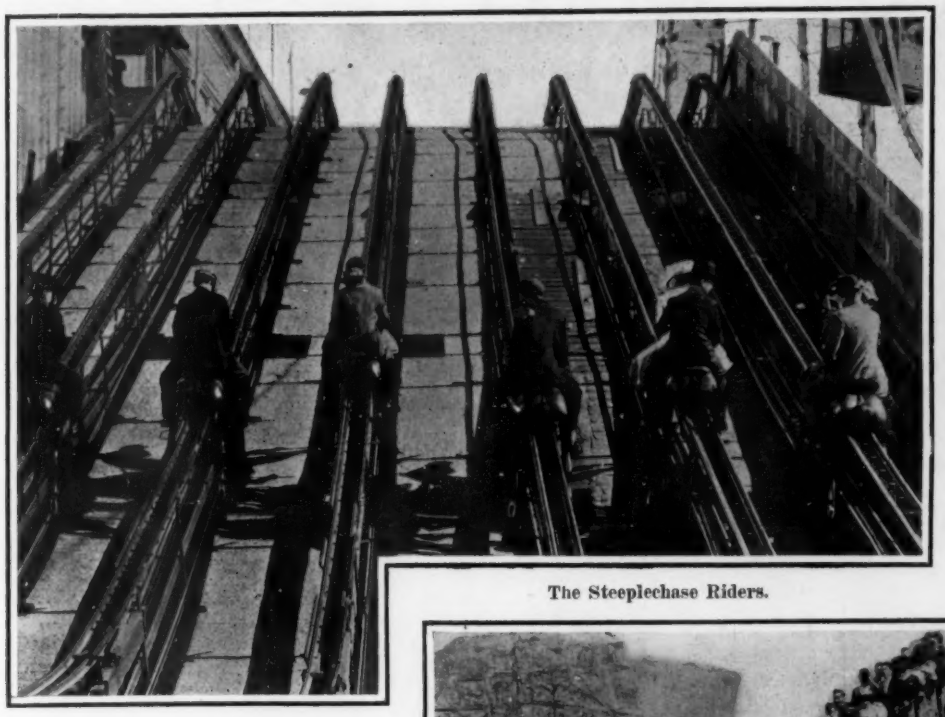
Life at Coney Island is very complex and runs the gamut from an exclusive cottage colony and luxurious hotels, way down to a liberal installment of the submerged tenth. It has its joys, its sorrows, its churches, missions, schools, and seaside-rests which give surcease from the stifling tenements of the East Side for sick babies and wan mothers. Saturday and Sunday the sandy little Island has its crowd of five, six, or even seven hundred thousand day visitors, who tax the transportation companies' resources to the utmost. Monday or Tuesday is the best day on which to visit the Island to those who wish to obtain some idea of its mechanical mysteries, as then the resort is comparatively uncrowded. We have elucidated in the SCIENTIFIC AMERICAN of August 15, 1908, many of the illusions and amusement devices which flourish for a year or so and then give place to other novelties demanded by the fickle public taste. The great amusement parks of the West End or "Coney Island" proper, have to be practically rebuilt every two or three years, and each successive improvement tends to make the ever-present scourge of Coney Island less dreaded, for the resort has always been a prey to fire, but now thanks to the efficient high pressure salt water service, the Island is comparatively safe. The flimsy wooden construction of a dozen years ago has given place to steel, reinforced concrete, and fireproof wood work, and fire fatalities are now reduced to a minimum.

Most of the amusement devices we illustrate are on or near the so-called "Bowery" or in the amusement parks. The "Bowery" is par excellence the place for barkers' yells, mechanical pianos, hot corn, hot frankfurters, dips of death, swirly-swirls, loops, flip-flaps, and other innumerable devices for extracting the nimble dime. To those who are fond of the water we have bathing accommodations from handsomely fitted up bath houses with steam rooms and swimming pools for those who can pay well up to a dollar for the privilege of a sea bath, to more moderate establishments where a ten, fifteen, or twenty-five-cent charge is in vogue for the use of a bath house, suit, and a well-worn towel. In the height of the season on hot Sundays, a bath is a thing for which one may have to wait for hours, even in the first-class establishments. A few years ago the bathing beach was unclean to a degree, and a bather would bob up alongside decayed cabbages, ancient derby hats, barrel staves, and all the filth from the great city. Now, thanks to a rigorous harbor patrol, the water contains only its salts and a small amount of organic impurities which is inherent in all bathing beaches adjacent to a metropolis.

The third factor after amusements and bathing, is food. It would be a rash man who would attempt to enumerate the purveyors of food and drink on this congested little Island, probably two thousand would not be far from the mark. Everything can be obtained from the most expensive luxuries cooked by highly salaried chefs, down to the lowly but tasty hot beef sandwich, roasted in the good old-fashioned way on a spit over the glowing coals. Every peculiarity of taste is reckoned with and the cuisine is attractive enough to make a park of two or three hundred automobiles a common sight.

Paramount among the amusements on the Island are the "rides," which seem to be the logical outcome of the merry-go-round, and the exciting "shoot-the-chutes." The rides are dependent upon gravity or motors and are provided as auxiliaries to help up the steep places. The gravity railroads are safe and equally thrilling when well constructed, especially when protected with the device invented by Mr. Stephen A. Jackman, as shown in our issue of August 15, 1908. One of our engravings shows one of the thrilling descents on a ride known as "The Great Divide" in "Dreamland." The rides which have motor auxiliaries are not necessarily any safer than the gravity ride, but there appears to be

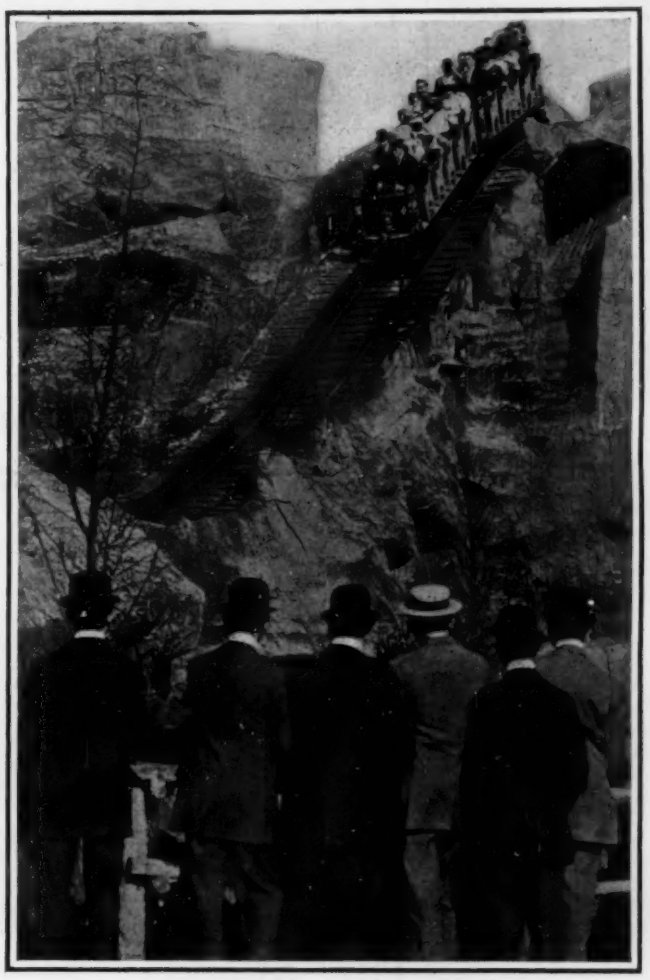
(*Continued on page 112.*)



The Steeplechase Riders.

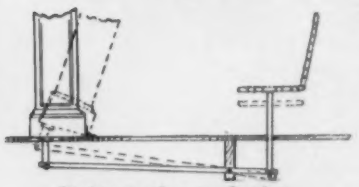
The collapsing elevator.

To the top of the "Chutes."



A Steep Descent on the "Great Divide."

The distorting mirror.



Statue moving mechanism.

The double whirl.

The eccentric statue.

THE MECHANICAL SIDE OF CONEY ISLAND.—WHERE THE IMAGINATIVE INVENTOR HOLDS SWAY.

MAGIC FOR AMATEURS—V

CARD AND COIN TRICKS

BY W. H. RADCLIFFE

NO. 11. FINDING A CHOSEN CARD BY INTUITION.

Any sixteen differently marked cards can be used in this trick to demonstrate to disbelievers the existence of a sixth sense.

Arrange the cards in four rows of four cards each, as in Fig. 16. For convenience in the present case ordinary playing cards have been chosen. Request one of the spectators to bear in mind any one of the sixteen cards and advise the performer in which horizontal row, 1-1, 2-2, 3-3, or 4-4, his selected card lies.

The performer now gathers up the cards in packs of four each, taking up the cards so that the fourth one in each pack is a card taken from the row designated. He then lays them out as before in four rows of four cards each, but takes care to place the cards of each pack in horizontal rows. If this be done, the cards in the designated row in the first lay-out will in the second lay-out be assembled in the fourth vertical row 5-5. The performer again asks the chooser to inform him in which horizontal row the card he previously selected lies, counting as before from the top horizontal row downward. With this information at hand the performer knows the card selected, because he has been advised at just which part of the row containing the card it is located. All that remains for him to do, therefore, is to show the card to the spectators in as dexterous a manner as possible.

Perhaps the best way of doing this is as follows: Pick up the sixteen cards in four packs of four cards each, being careful to have the selected card on top of one of these packs, face downward with the others. Place the four packs on the table, as in Fig. 17, being careful to remember in which pack the selected card lies. Suppose, for example, it is the top card in pack No. 3. Ask the party who previously selected the card to choose any two of the packs. If he says No. 1 and No. 2, or No. 1 and No. 4, or No. 2 and No. 4, remove the packs designated; if No. 1 and No. 3, remove packs No. 2 and No. 4; if No. 2 and No. 3, remove packs No. 1 and No. 4; or if No. 3 and No. 4, remove packs No. 1 and No. 2.

There then remains two packs on the table, of which one is No. 3, containing the selected card. Ask the party to choose one of these two packs. Regardless of which he chooses, remove the pack which is not No. 3. The chooser will usually not notice that the performer follows his own will in taking up or leaving the cards chosen; at any rate he cannot be sure of any inconsistency until after the second choice is made, and if the performer explains that he always follows the method then used, the chooser will assume that the performer did so before.

Having now sifted the matter to one pack, by intuition according to the performer, let him continue to demonstrate the existence of this sixth sense as follows: Spread out the four cards of this pack faces downward on the table. Taking the chooser's hand in one of his, the performer picks up with his other hand the card which was previously on top of the pack. This card, it will be seen, cannot fail to be the one selected by the chooser at the beginning of the trick.

NO. 12. FORCING A COIN THROUGH THE BODY.

No apparatus is used for this trick, which is a very effective one for an impromptu exhibition.

A dime is first handed to the spectators to be marked by them for later identification. After it has been returned to the performer he takes it between the finger tips of his left hand and proceeds to rub the coin back and forth on the coat sleeve of his right arm near the elbow as shown in Fig. 18. He explains that by so doing, the small particles or atoms composing the coin become separated and enter his blood.

After a few such movements he drops the coin on the table or floor (apparently by accident) and, picking it up with his right hand, makes a move as if to transfer it to his left hand. The instant the two hands come together, the fingers of the left hand are moved so that they appear to grasp the coin, while the right hand thumb quickly presses the coin in between the first and second fingers of the right hand and is held hidden between them. If the performer has turned his head and eyes to follow the supposed movement of the coin from the right hand to the left, none will doubt but that the dime is in the left hand. The performer now stands with his left side toward the spectators and again raises his right hand to the right side of his head near the right ear in affording access to his right elbow.

Both hands must now get active, the left apparently rubbing the coin on the sleeve, and the right secretly inserting the coin in the cavity of the right ear. The right hand being hidden from the spectators by the performer's head, its movement is unnoticed by them.

When the dime has been pushed securely into the ear, the performer remarks that the coin he is rubbing seems to be getting smaller. Lifting first one finger

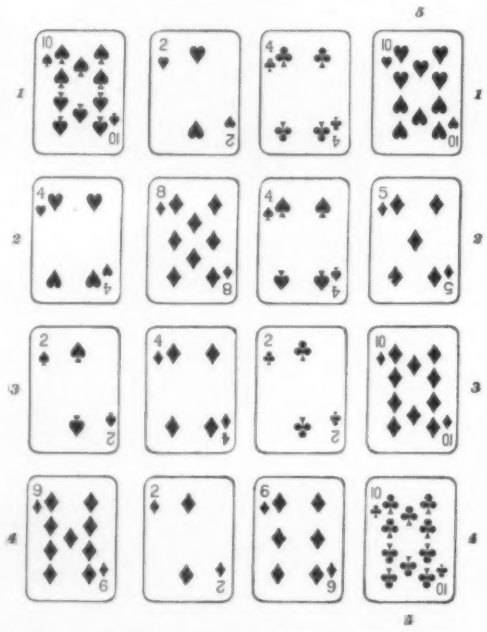


Fig. 16.—FINDING A CHOSEN CARD. A CHOICE IS ALLOWED AMONG 16 CARDS ARRANGED IN 4 ROWS OF FOUR CARDS EACH.

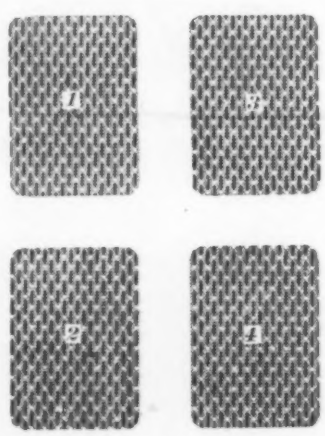


Fig. 17.—FINAL GROUPING OF CARDS FOR RESULTS.

Fig. 18.—FORCING COIN THROUGH BODY. ATTITUDE OF THE PERFORMER.

from the coat sleeve, then another, and finally all of them, he shows the dime has actually vanished.

Claiming the coin to be now thoroughly diffused throughout his blood, he asserts he is able to make it reappear at any part of his body. Before suggestions are offered as to which part of the body it shall be produced, the performer adds that to make it develop in his ear all that is necessary is to force the blood toward that particular member. After stroking his head a few times with his hand toward the right ear and showing his right hand empty, he inserts the fingers of this hand into his ear, pulls out the dime, and passes it to the spectators to be identified as the one previously marked by them.

How to Color Steel.

TO IMPART A BLACK COLOR, PERMANENT AND FREE FROM RUST, TO STEEL.

1. To insure success, the steel articles must previously be polished and freed from grease. When this is done, prepare a bath of 1,000 parts of hot water and dissolve the following chemicals in it: Five parts of caustic potash, 10 parts of potassium cyanide, 5 parts of potassium chlorate, 0.5 part of white arsenic and 20 parts of Schlippe's salt (sulph-antimoniate of sodium).

Use the bath with zinc contact; if it is of moderate temperature, the color will range from pearl-gray to gray-black; by adding about 20 parts of copper hemisulphide it will become deep black. It is advisable previously to matt the article with the steel matting brush.

2. The second process is to be applied cold and without any contact. Coat the articles by means of a brush with a solution consisting of 2 parts of hydrochloric acid, 2 parts of water and 1 part of tin-salt.

After about 15 minutes coat with a copper solution consisting of 1 part of blue vitriol in 16 parts of water with the addition of sufficient aqueous ammonia to dissolve the blue deposit which has been formed to a clear blue fluid. When the article is dry after this process, wash it well with water and place it for a few minutes in a diluted solution of potassium sulphide. Then remove it, rinse it well with water and dry it. A dead gray-black color will be obtained by this process.

3. Prepare a stain compounded as follows: One part of bismuth chloride, 2 parts of mercury chloride, and 1 part of copper chloride dissolved in 6 parts of hydrochloric acid, 5 parts of alcohol and 50 of water. Dip the article, previously polished and freed from grease, into this solution, but instead of dipping, apply the solution with a small brush if hinges and pieces of some other metal have been soldered onto the steel article. When the solution is thoroughly dry, immerse the articles for half an hour in boiling water; a gray-black color will be obtained. After the process has been repeated, the color will turn to black. After the treatment, rinse the object well, leave it to dry and rub with a little wax.

TO COLOR STEEL ARTICLES BLUISH GRAY.

Prepare a bath of the following solution: Dissolve 140 parts of sodium hyposulphite in 1,000 parts of water; also dissolve separately 35 parts of lead acetate in 1,000 parts of water; stir both solutions together and heat the mixture slowly till it boils. Then place the article in the bath, and after further boiling the desired blue-gray color will be imparted. Then remove the goods, dry them well and leave them for a few hours to cool. Finally polish with a good polishing iron.

The following process can also be highly recommended: Dissolve separately 3 parts of hepar and 1 of sugar of lead in water and dilute both solutions considerably; then mix them together. No special care need be taken in diluting, for the more the solution is diluted, the more beautiful will be the color, though the process may be lengthened. Put the objects in the solution, taking out a sample from time to time to see if the required color has been acquired. All shades of color, from blue-gray to black, can be produced in this bath. Rinse well and dry the articles. —Journal der Goldschmiedekunst.

A $15,000 Prize for Aeroplanes.

Mr. Edwin Gould has offered, through the columns of the SCIENTIFIC AMERICAN, the sum of $15,000, which is to be awarded for the construction of a heavier-than-air flying machine, equipped with more than one motor and propeller.

The conditions governing Mr. Gould's offer were published in the SCIENTIFIC AMERICAN, issue of July 30th.

THE DUFESTEL THORACOGRAPH

BY CHARLES PERRIN.

The thoracograph invented by Dr. Dufestel is a device for obtaining diagrams showing the movements of the chest during the act of respiration. The 1910 model of this apparatus is illustrated in Fig. 1. From a strong platform, which rests on three leveling screws, rise two posts, one of which is much heavier than the other. The posts are connected by a horizontal bar of metal, which can be moved up and down. The height of the subject can be measured by bringing this bar into contact with the top of his head and reading its position on a scale of millimeters engraved on the heavy post. In measuring the movements of the chest this bar is raised above the head, and to it are attached a photographer's head rest, by which the head is kept motionless, and two rods by which the arms can be supported in any desired position. The pelvis is kept motionless by a clamp attached to the large post, and the lower part of the spine is immobilized by two rods which are associated with the large copper circle and are not clearly shown in the photograph. By these means the subject is supported in a comfortable position, with entire freedom of respiratory movement, while movements of other parts of the body, which might impair the accuracy of the record, are prevented.

The chest of the subject is surrounded by a copper ring, 18 inches in diameter, which is supported by a horizontal tubular arm attached to a carriage which moves on wheels along the main post and can be clamped at any height. A flexible arm connects the ring with the slender post. The recording apparatus is attached to a carriage which rests upon the ring and which can be moved round its entire circumference by a clockwork having a pinion which engages with the teeth of a gear cut on the ring.

During this revolution a small ebonite wheel, attached to one end of a pantograph, is kept by a spring in contact with the chest, side or back of the subject. The other end of the pantograph carries a pen in contact with a sheet of cross-ruled paper attached to an aluminium disk which rotates, relatively to its support, with the same angular velocity with which the support moves round the ring, but in the opposite direction. These opposite rotations compensate each other, so that the lines ruled on the paper always remain parallel to their original directions. The drawing pen and the ebonite wheel which touches the skin of the thorax move radially, and the displacements of the pen are exactly half as large as those of the wheel. Hence, as the wheel travels completely round the subject, the pen draws the complete contour of a horizontal section of the thorax, of one-half the natural dimensions.

The operation of the apparatus presents no difficulties. The subject takes his place on the platform, the various supports and restraining devices are adjusted, the copper ring is set at the proper height, the ebonite wheel is placed in contact with its stop and with the skin of the subject, and the clockwork is wound up. The subject draws a deep breath and holds it while the wheel, started by releasing a catch which controls the clockwork, travels completely round his thorax until it again strikes the stop. During this movement the pen traces on a reduced scale the contour of the inflated chest, which is indicated by the dotted line in Fig. 3. The operation is then repeated with the chest deflated, producing the curve indicated by the full line.

The comparison of two pairs of contours of the same part of the chest, traced at different epochs, reveals the changes in the form and action of the pulmonary organs that have taken place in the interval. Hence Dr. Dufestel's apparatus will render valuable service to physiologists and physicians by showing the effects of disease and of breathing exercises and other remedial treatment.

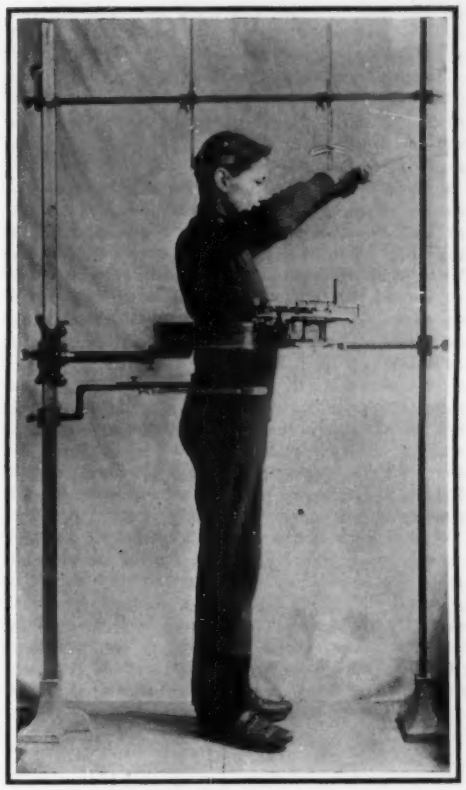


Fig. 1.—The thoracograph in operation.

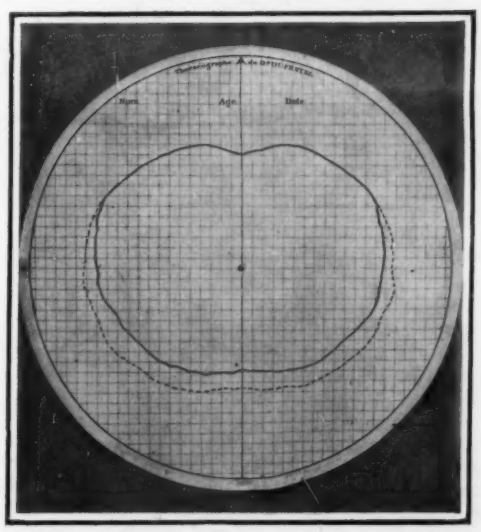


Fig. 3.—Contours of inflated and deflated chest traced by the thoracograph.

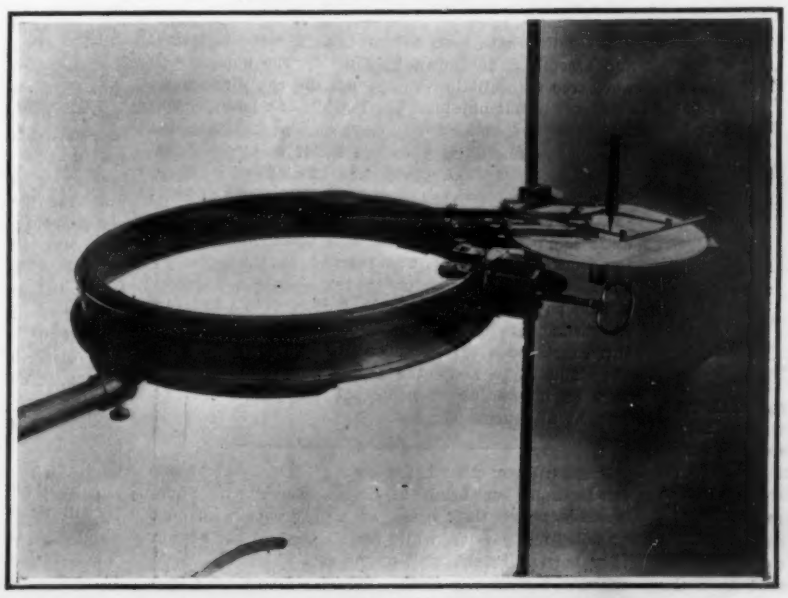


Fig. 2—DR. DUFESTEL'S THORACOGRAPH.

The Revival of Ozone Studies in Meteorology.

In an earlier generation the word "ozone" loomed somewhat large in meteorological literature; especially in that intended for popular consumption. Ozone observations were eagerly prosecuted in view of the supposed hygienic importance of this substance, due to its actively oxidizing properties. That ozone plays any important part in the great dynamic processes of the atmosphere was not suspected.

The ordinary method of observation was to moisten and expose to the air strips of blotting paper or filter paper steeped in a solution of potassium iodide and starch. An ozone-laden atmosphere turns this paper blue, and the intensity of the color, expressed according to an arbitrary scale of tints, was taken as a measure of the amount of ozone present. A large body of observations was thus accumulated; all of which are unfortunately vitiated by the fact that the test-paper reacts to other occasional constituents of the atmosphere as well as to ozone—especially peroxide of hydrogen and nitric acid.

The question of ozone observations was considered by the International Meteorological Congresses at Leipzig (1872), Vienna (1873), and Rome (1879), and the conclusion was reached that the serious prosecution of such observations on a large scale must await the introduction of more suitable forms of apparatus than any thus far proposed.

However, after ozone observations had dropped out of the routine of most large observatories they were kept up by the amateur meteorologists, and probably still are to some extent, as the instrument-makers continue to advertise many forms of ozonoscopes, ozonometers, ozonographs, etc.

The rehabilitation of the study of ozone, as a subject requiring the earnest attention of meteorologists, may be said to date from the year 1904, when the late Knut Angström, by examining the absorption bands of the solar spectrum, detected the presence of a large amount of ozone in the atmosphere, the bulk of which was evidently in the upper strata, since it was known that only small quantities exist near the earth's surface. Subsequent investigations have shown that all the conditions of the upper atmosphere are, in fact, very favorable for the production of ozone. In 1906 Ladenburg and Lehmann showed that a number of ozone absorption bands are scattered through a wide range of the solar spectrum, including the ultra-violet and the ultra-red.

This subject has lately been taken up by Prof. W. J. Humphreys, of the U. S. Weather Bureau, who, proceeding from Angström's suggestion that ozone must, by absorbing radiation, exercise an important effect upon the thermal phenomena of the atmosphere, has brought to notice several factors of the problem not suspected by Angström, and has opened up a new and promising field of investigation.

Humphreys has shown, from the distribution of the ozone absorption bands in the spectrum, that the coefficient of absorption, due to ozone, is much smaller for the relatively short wave-lengths belonging to solar radiation than for the longer wave-lengths of earth radiation. In other words, ozone lets solar radiation in much more readily than it lets earth radiation out, and an effect of an increase in the amount of ozone in the upper atmosphere must be an increase in the temperature of the air beneath.

The recent discovery that ozone is produced from dry oxygen by the action of ultra-violet light leads to the belief that such light, received from the sun, is an important cause of the production of this substance in the atmosphere, another being electrical discharges, auroral and otherwise. A low temperature, such as prevails in the upper atmosphere, is also known to favor both the production and the conservation of ozone. It thus appears that the upper air is rich in ozone, and that this substance exercises an imporant influence upon terrestrial temperatures. Humphreys has also shown in an ingenious manner that there is a decrease in the ultra-violet radiation from the sun at the time of sunspot maximum, owing to the increased dustiness of the solar atmosphere at that time and the consequent cutting off of a relatively greater proportion of the radiation of short wave-length. This should result in a decrease in the amount of ozone in the upper atmosphere, an increase, for the reasons above stated, of atmospheric diathermancy, and a decrease in terrestrial temperatures.

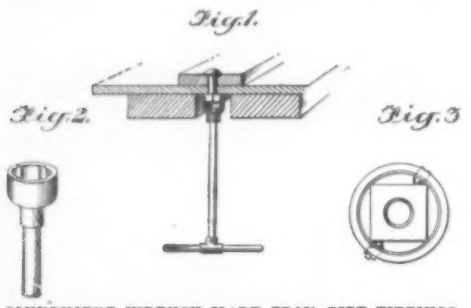
The study, by spectroscopic methods, of the ozone content of the atmosphere appears to be one of the most important meteorological undertakings of the immediate future, and a proposal looking to the inauguration of such work in various parts of the world has been addressed to the International Meteorological Committee by the Chief of the Weather Bureau.

HANDY MAN'S WORKSHOP

IMPROVED CORNER WRENCH.

BY D. PENNINGTON.

The accompanying illustration shows a convenient wrench made from pipe fittings for the purpose of

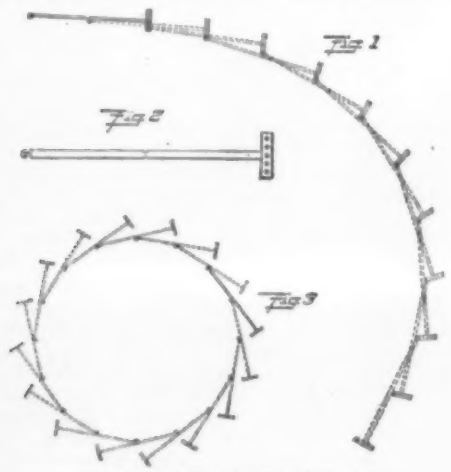


CONVENIENT WRENCH MADE FROM PIPE FITTINGS.

tightening nuts that are inaccessible to an ordinary wrench. The wrench is made by filing four grooves within a common reducer, as shown in Fig. 2, to fit the corners of the nut. Instead of filing grooves in the reducer, studs may be screwed through the sides as shown in Fig. 3. Reducers of different size should be used to fit different nuts. A hole may be drilled through the connections, and a pin inserted to prevent them from unscrewing while the wrench is used for tightening or loosening a nut.

LAYING OUT A CURVED WALK.

It is no small task to lay out a walk with irregular curves and have the curves graceful. Unless the work is carefully done, an angular effect will be produced which will spoil the appearance of the garden or lawn through which it runs. A very simple implement may be devised out of a stick with a crosspiece, with which one can transfer curves that are carefully drawn on paper, to the walk itself. Two implements will be required, one for use on the lawn, and the other of smaller dimensions for use on the drawing table. As indicated in Fig. 2 of the accompanying drawing, the implement is provided with a hook at one end, while several holes are bored through the crosspiece. The rod is also notched at the center. A pin is stuck in the paper at one end of the curve. The rod is hooked over this pin and a second pin is stuck in the paper opposite the notch in the center of the rod. A third pin is now driven through the hole of the cross-piece under which the curve runs. The next step is to hook the device over the second pin, rest the notch against the third pin, and insert a fourth pin through the cross-piece at the point where it intersects the curve. Proceeding in this way, a series of pins are placed in the paper along the curve, and opposite each is indi-



LAYING OUT A CURVED WALK.

cated the number of the hole in the crosspiece through which it was inserted. Now, taking the large implement, the same curve can be reproduced to actual working dimensions by driving pegs in the ground through the holes specified on the drawing. In the case of an abrupt curve, or if it is desired to lay out a circle, as in Fig. 3, the cross-piece may not be found long enough, but the distance of the cross-piece from the curve at each step may be transferred from the working drawing to the actual work if the relative sizes of the drawing instrument and the working implements are known. By proceeding in this manner, curves of any form may be laid out.

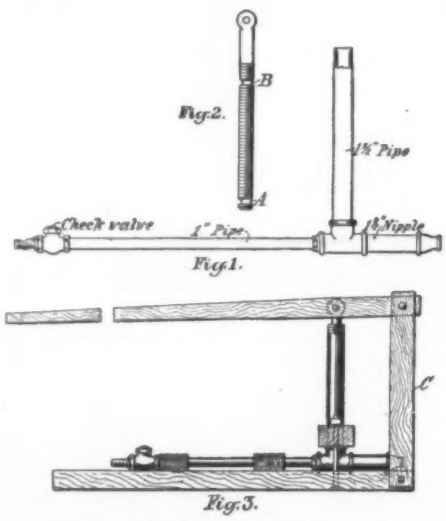
AN EMERGENCY PRESSURE PUMP.

BY E. R. TABER, JR.

Some time ago I noticed in the Handy Man's Workshop a simple pressure test for a boiler, which consisted in completely filling the boiler with water, closing all outlets, and raising the temperature until the desired pressure was reached; and not long after a freeze gave me an opportunity to try the experiment myself. It was a sixty horse-power boiler in an isolated place, so that the problem had but two solutions, viz., to test the boiler and start up that day; or to send to the nearest city for some owner of a pressure pump, lose several days perhaps, and pay fees and expenses besides. The boiler was accordingly filled with water until it overflowed at the whistle, and all valves were closed. The fire was then started, but owing to several small leaks which could not just then be mended, the pressure never rose above 10 pounds. After a second attempt, the idea was given up.

Now, on the place there was a blacksmith's shop, containing the usual small number of dilapidated tools found in a country shop; and a building containing pieces of worn-out machinery. After searching the latter with the diagram of a crude pressure pump in mind we found, inside of half an hour, sufficient material for an emergency apparatus.

To start with, a tee was built up out of wrought-iron pipe and pipe fittings. Fig. 1 gives the principal dimensions of this tee. The vertical pipe served as the cylinder, and for the plunger we used an eyebolt wrapped with twine. Two grooves were filed in the eyebolt, as shown at *A*, *B* in Fig. 2, and several strands of bagging twine were twisted together, one end being spread out and firmly bound to the screw at the lower



PRESSURE PUMP FOR BOILER TESTING.

notch *A*. Then the twine was carefully and tightly laid in the threads of the screw until the next notch *B* was reached. Here it was again spread and bound as before. A sufficient number of strands was selected to give the plunger about 75 pounds friction when oiled and inserted in the cylinder. The mouth of the cylinder was belled out as much as possible with a round file so as to receive the plunger without cutting the packing.

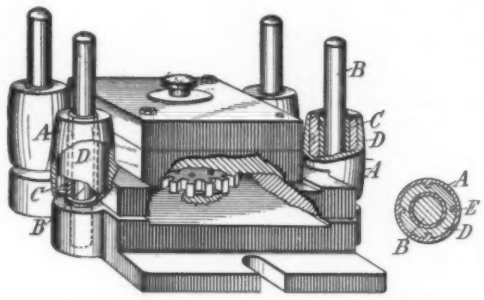
The pump was then mounted on a wooden frame and assembled as shown in Fig. 3. The supports *C* were free to oscillate, thus permitting the plunger to operate without binding. Having but one leaky check valve on the pump, it was used on the suction side, the injector check valve on the boiler being used for the other side. The pump was started with three men at its cumbersome lever. It worked like a charm, and the pressure went up 10 pounds at every stroke until 155 pounds (which was half again as much as the working pressure) was reached on the pressure gage.

This having worked so well, I decided to put it up in permanent form; and with a little expense for three new check valves, and a little work in the wood shop and forge shop, the pump was completed. It may be interesting to note that the piston did not leak at all during the test.

Brass rails or other brass work on launches or boats can be easily kept bright by the use of sperm oil. Some boatmen polish their brass work only once with putz or polishing powder, while for the rest of the season they keep it bright with sperm oil, which is rubbed on with a very oily cloth. Before starting on a trip the brass work is rubbed over with the sperm oil cloth to prevent the salt from reaching the brass, and on the return the salt is readily taken off, leaving the rail bright. This method was recently suggested to an automobilist, who found it to be a great success, because he could polish up his brass very easily after it had been left several days.

LINING UP A PUNCH AND DIE.

The die block illustrated herewith has four upright round guides. The punch block has four lugs *A* cast on and cored out. Four sleeves *C* are made of cast iron, and nicely fitted to the upright guides *B*. The upper block, which carries the punch, is lifted up over the four guides and lowered so that the punch enters the die at the proper place. Now there is a



METHOD OF LINING UP A PUNCH AND DIE

space between the sleeves *C* and inner walls of the lugs *A*, sufficient to receive the babbitt *D*, which is poured in around the sleeve. Each lug is babbitted, and when cold the punch block will freely rise. On the downward motion the punch will enter the die perfectly. The lugs have small projections *E* inside to prevent the babbitt from swiveling. The whole is placed in the press. The lower half holding the die is strapped down. The upper half carrying the punch is attached to the moving head in the power press.

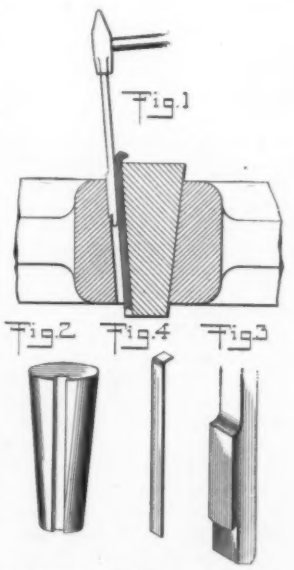
IMPROVED METHOD OF CUTTING KEYWAYS.

BY J. B. ALLEN.

The accompanying illustrations show how a keyway can be cut in a hub by hand, without the aid of any machine tools, and yet be just as accurate.

A dummy center or plug is first made to fit the hole which is to be provided with the keyway. The hole may be either straight or tapered. A keyway is cut in this plug, either by hand or machine. This keyway must be of the same width as the desired keyway in the hub. Fig. 2 shows the plug ready to be used.

A chisel or drift, same width as the keyway, is then made, as illustrated in Fig. 3. This can be made in any suitable thickness, only not thicker than the keyway in the center part. It will be noticed that the right-hand corner is somewhat rounded off. This is done so the drift will not stick in the slot. At the opposite side, somewhat higher up, is a rounded cutting edge. This is undercut, which of course affords a better cutting edge. The drift should be made parallel all over, so it will not wedge or jam when in use. A number of thin liners or shims are provided, of the same width as the chisel, as illustrated in Fig. 4.



IMPROVED METHOD OF CUTTING KEYWAYS.

The operation is as follows: First, insert the center in the hub, as shown in Fig. 1. Then start the drift at the top, and with a hand or a sledge hammer, according to size, drive the drift clear through the hub. Pull the drift out and start as before, with this difference, however, that between the drift and the center is placed one of the shims. The drift is again driven through. It will now be noticed that a cut is made in the hub equal to the thickness of the shim. Proceed in this manner until the required depth of the keyway is obtained.

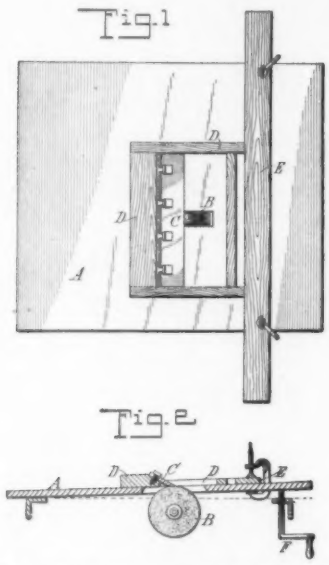
A little oil or grease should be used on the drift, so it will not stick. When the keyway is finished the number of liners, chisel, and center used in producing a certain keyway may be stored away, and kept; then in case another keyway or hub is to be produced, it will be an easy matter to do so. For instance, if a

keyway is made in the hub of a propeller and this propeller is lost, it would be an easy matter to duplicate it with a perfect fit, both as to taper and depth of keyway.

METHOD OF GRINDING PLANER KNIVES.

BY C. M. EVELETH.

I am sure many readers of Handy Man's Workshop, like myself, have a saw table and a buzz planer, but



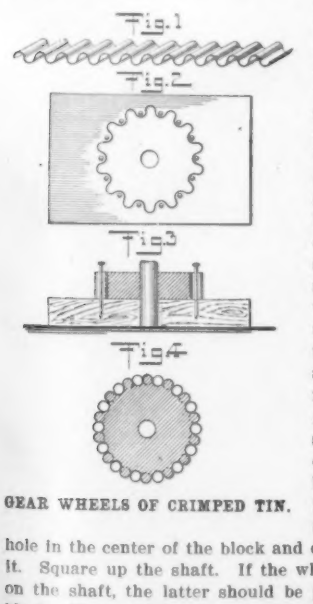
SIMPLE METHOD OF GRINDING PLANER BLADES.

no emery grinder adapted to grinding the knives. The following method therefore of doing the work I have found to be entirely practical. Referring to the sketches, Fig. 1 is a plan view of the top of the saw machine, and Fig. 2 a sectional view. *A* is the saw table, *B* an emery wheel on the arbor in place of a circular saw, *C* is the planer knife bolted to a beveled piece of hard wood of the frame *D*. Use the same bolts that held the knife in the planer, taking care to have the holes of a size that will allow them to thread themselves snugly in the wood. Place the frame *D* on the table so that the knife *C* will come over the wheel *B*. Clamp a straight edge *E* across the top of the table for the frame to slide against. To do the grinding, grasp the frame with the hands and move it so as to carry the knife laterally over the wheel. Keep the frame steady on the table and against the straight edge. Adjust the height of the table by means of the screw *F* as the knife is ground away. Care should be taken to grind an equal amount from each knife, to keep the balance right.

HOW TO MAKE A SERVICEABLE GEAR-WHEEL.

BY JOHN A. BERGSTROM.

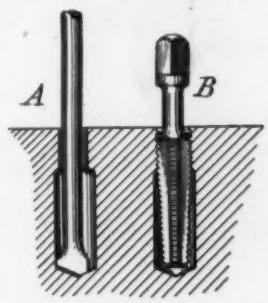
The accompanying illustrations show how a serviceable gearwheel can be made from corrugated tin. A strip of ordinary tin (that is, tin-plated steel) the width of the wheel wanted, is put through an ordinary tinner's crimping machine, making it corrugated as shown in Fig. 1. This corrugated strip is now formed into a circle (see Fig. 2) the size of gear wanted, and soldered. On a block of wood lay out a circle the size of the pitch diameter of the wheel, and place the corrugated ring thereon. Now drive a number of small nails into this circle in the outside corrugations of the ring, thereby shaping them into a nearly perfect circle. Bore a hole in the center of the block and drive the shaft into it. Square up the shaft. If the wheel is to run loose on the shaft, the latter should be painted with lampblack. The mold for the wheel is now ready for casting. A quantity of babbitt or other hard metal, such as type metal or the like, is melted and poured into the mold to a level with the top of the corrugated ring. Some suitable flux should be applied to the tin on the inside so that the molten metal will adhere thereto, and form a solid wheel. The wheel will be found very serviceable, inasmuch as the surface is steel coated. A rack, an internal, external, or elliptical gear can be made in this manner. The writer has made a number of these gear-wheels for experimental machines, and has found them to answer all purposes. The corrugated strip may of course be nailed to a wooden center instead of filling it up with metal. If a more accurate gear-wheel is wanted, it can be made as follows: The width of the gear may be divided into two or more sections, one section soldered and placed on top of another in a staggered position, as shown in Fig. 4, and finished as before described. If a different pitch is wanted, different crimpers may be attached to the crimping machine, which will give smaller or larger corrugations on the strip of tin.



GEAR WHEELS OF CRIMPED TIN.

CHAMBERING OUT A HOLE.

Mr. George Bigelow, a well-known machinist, wanted to tap out a 5-16-inch hole with an odd-numbered thread, and could find nothing available for that thread except a tapered tap. Realizing the time and trouble that it would take in using this in a parallel hole, he hit upon the method of chambering out the hole with the same drill that he used for tapping out. He drilled all the holes that he desired ⅜ of an inch deep, and after this he sharpened the point of the drill to one side of the center, as in Fig. 1. Then he inserted the drill in the holes that were already ⅜ of an inch deep, and continued the hole, but of a larger diameter, to the desired depth. The enlarged hole allowed the point of the tapered tap to run in freely. Sharpening a drill with a point out of the center, in order to drill a larger hole than the drill itself, is pretty well known, but the use Mr. Bigelow put this wrinkle to is quite unique.

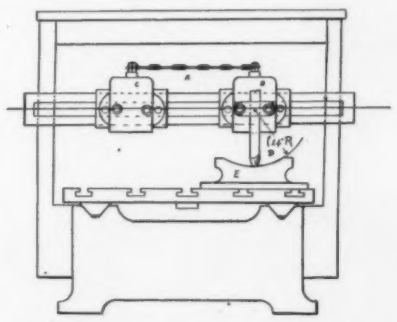


CHAMBERING OUT A HOLE.

HOW TO CUT A CURVE ON A PLANER.

BY H. D. CHAPMAN.

A number of castings were recently brought to the shop where the writer works. Each casting was to be finished 24 inches square, and had to have a 14-inch radius cut through the center as shown at *E* in the accompanying drawing. The job was too large to clamp on the lathe carriage and allow for a cut of 14-inch radius, so after a little thought we rigged up the planer as shown in the accompanying drawing. Five of the castings were clamped on the machine at a time, and the job was soon finished. The tool was set central with the casting. The planer head *B* was locked to the cross beam, but the swivel was left free to turn. The head *B* was connected to the head *C* by the chain *A*. The cross feed was put on the head *C*, and it swung the head *B* and the tool through the desired sweep. A first-class job was done in a very short order.

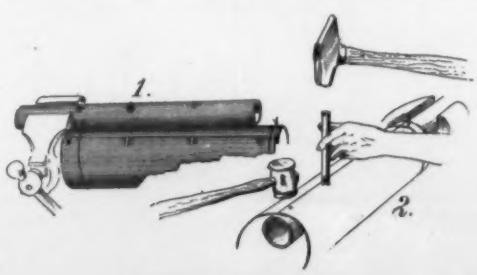


CUTTING A CURVE ON A PLANER.

QUICK METHOD OF RIVETING ROUGH WORK.

BY A. F. BISHOP.

Riveting stovepipe seams, where you are obliged to punch the hole first and place the rivet by hand, is very bothersome. The following wrinkle will be found helpful. First form the pipe into a cylinder, and chalk along the seams where you want the rivets. Chalk marks are put on an iron bar or gas pipe to correspond with the chalk marks on the pipe. The rivet is then placed on the chalk mark on the bar, as in Fig. 1. Slip the pipe over, and rest it on the point of the rivet. Strike on the chalk marks which are supposed to be over the rivet with a lead hammer or mallet, as in Fig. 2. This will make a slight projection, which will show you where to place the hollow set exactly over the rivet. One blow of the hammer will force the rivet through the metal, the next blow will rivet it. The rivets can be made out of common wire nails with quite a large head, and cut the proper length with cutting pliers. A piece of hickory with a hole drilled in one end can be used for the set, but it makes quite a rough job.

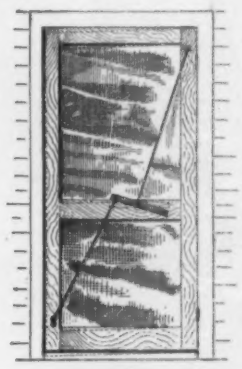


RIVETING ROUGH WORK.

CURE FOR SAGGING SCREEN DOORS.

BY ROBERT H. BROCKMAN.

A satisfactory method of truing up a screen door is as follows: Take two pieces of wire, size No. 12 or 14, and twist a loop in each end of each piece. One of the loops is to be hooked over a round-headed screw, and the other should be large enough to fit over a lever of 1¼ by ½-inch hard wood, 8 inches long. The wood should be notched to prevent the wire loops from slipping off. The wires are applied to the screen door in the manner shown in the accompanying sketch. They should be so adjusted that before the sag is taken up the lever will be horizontal, as indicated by dotted lines. Then by twisting the lever to the position shown by full lines, the door is trued up. The end of the lever is then made fast to the crossbar of the door by means of a screw.

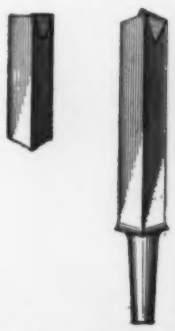


CURE FOR SAGGING SCREEN DOOR.

IMPROVED MORTISING CHISEL.

BY GEORGE A. PAGE.

The double-prong chisels used for cutting mortises in window sashes may be improved by sharpening the cutting edges on an angle, instead of square with the body of the tool, so that in use a shearing instead of a chopping effect is provided. The cutting edges of the two prongs should be inclined in opposite directions, as shown in the cut, so that the thrust of one will counteract the thrust of the other.



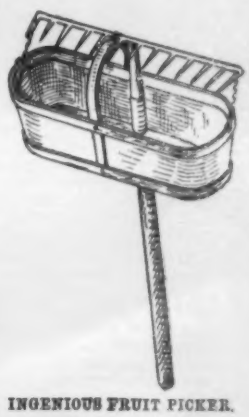
OLD AND NEW WAY OF SHARPENING A DOUBLE PRONG CHISEL.

HASTILY-MADE FRUIT PICKER.

BY THALEON BLAKE.

Owing to sunshine, free play of air, and warmth from direct sun rays and reflected rays, the larger, better, sweeter and riper apples, pears, peaches—and indeed most fruits—are to be found at the top of the fruit trees and near the tips of lower branches. Much of this choice fruit is hard to gather without bruising it. A home-made fruit picker, such as that shown in the illustration, may be very hastily assembled, and will be found to take the place of manufactured ones. By reasonable care in pulling the fruit, the skins will not be scarred, and they will keep as well as hand-pulled fruit.

The fruit picker consists of a garden rake tied to the handle of a common grape basket, with the handle of the rake projecting through the bottom of the basket. The end prongs are also tied to the basket. The device is far more useful than its looks might seem to indicate. However, it will not enable one to reach very high unless the handle is extended by splicing the rake to a long pole.



INGENIOUS FRUIT PICKER.

RECENTLY PATENTED INVENTIONS.

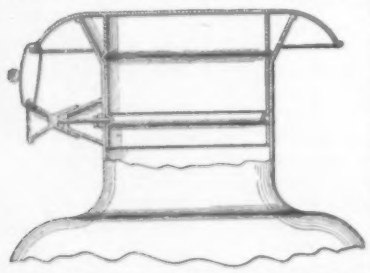
Electrical Devices.

STORAGE BATTERY INDICATOR.—P. M. MARKO, New York, N. Y. Mr. Marko provides a resistance arranged in parallel with a voltmeter, so that upon closing the circuit through the latter, the circuit will be closed through the resistance. This puts a load on the battery which approximates the normal load on the battery when the battery is in operation, and thus the reading on the voltmeter will be substantially the same as would be the reading were the battery in operation at the time it was tested.

STORAGE BATTERY.—P. M. MARKO, New York, N. Y. The inventor's aim is to provide a battery having a self-contained electric meter by means of which the strength of current in the battery can be ascertained at any time, which is so constructed that the meter can be easily removed from the battery without disturbing the shunt connections for conducting current to the meter, and in which a resistance is provided for use with the meter.

Of Interest to Farmers.

MILK CAN.—ANDREW M. BROOKS, Cherry Valley, N. Y. The accompanying illustration shows a novel system of locking and sealing the cover of a milk can, so as to prevent meddling with its contents. The cover is formed with a sleeve which fits into the neck



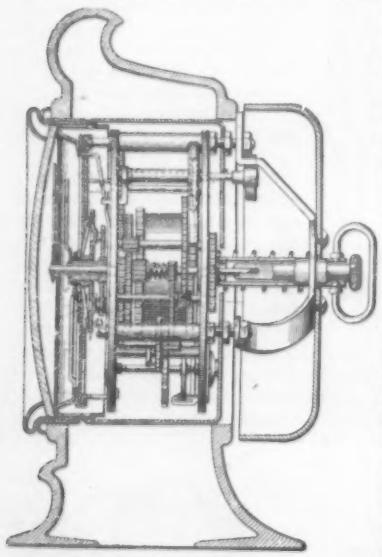
NOVEL SYSTEM OF LOCKING AND SEALING THE COVER OF A MILK CAN.

of the can and has an annular recess adapted to receive a locking screw. The handle of this screw may be sealed by means of a wire connecting it with the top of the cover as shown.

BEEHIVE ATTACHMENT.—S. BLAGG, Erie, Ill. The invention is in the nature of a frame adapted to be clamped detachably to a beehive and for use in removing filled supers, which operation may be effected with safety to the apiarist. The manner of applying and using the detachment is simple and very effective.

Of General Interest.

ALARM CLOCK.—ACHILLE KAISERMAN, Kankakee, Ill. By an ingenious arrangement, this alarm clock may be set to ring at any desired time to the very minute. A single spring is used for the movement, and for the alarm, a device being provided for coupling



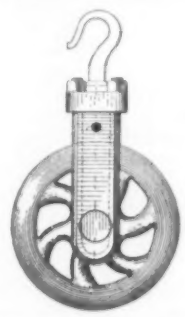
IMPROVED ALARM CLOCK.

the alarm mechanism with the main spring. This coupling may be disconnected at any time. The mechanism is very simple and inexpensive, and the fact that the alarm does not have to be separately wound is a great convenience.

TRIPOD.—J. D. BOYD, Pittsburg, Texas. The tripod can be folded into such shape that it may resemble, and may be used as a walking stick. The invention provides a handle for the tripod when used as a walking stick, it being possible to open the handle in which means are provided by which a camera may be firmly secured to the tripod irrespective of the depth of the tripod socket in the camera.

COVER.—F. E. TEVES, Glen Cove, N. Y. This invention refers to improvements in detachable covers for receptacles, chambers, or containers, and the object of the inventor is to so construct the cover that all moisture condensing upon the inner surface will return to the container, and the taking off or the putting on of the cover will not produce any appreciable noise.

SHEAVE BLOCK.—JOHN A. LOCKFAW, Wilmington, N. C. This block is adapted particularly for use on ships and on logging machinery. The sheave is mounted to turn on a fixed shaft, supported in a pair of side pieces



SELF-LUBRICATING SHEAVE BLOCK.

which are proved, as indicated in the drawing, to receive a pair of U-shaped bolts connecting them to a cross piece at the top. The side pieces, as well as the shaft, are provided with channels in which oil may be poured to lubricate the sheave.

PROCESS OF MAKING DECORATED CONCRETE TILES.—F. J. STERNER and W. A. ROSE, New York, N. Y. This invention pertains to improvements in the manufacture of concrete tiles for use in building construction, and more particularly to a process whereby any picture, drawing, design, or the like may be reproduced in concrete, in the form of a slab or tile, the different portions of the design being in appropriate colors.

METHOD OF HANDLING MATTE.—W. D. KILBOURN, Murray, Utah. Among the principal objects in view in this case are: to so handle the matte that it will, in cooling, separate into fragments which may be delivered to the crusher without being manually broken; to prevent the bursting of large bodies of matte; and to provide an apparatus for so shaping the matte as will cause the same to separate into predetermined sizes and shapes upon cooling.

WATERPROOF FUSE-CAP.—T. M. DANIELS, Chicago, Ill. This invention has reference to certain improvements in water-proof fuse caps for use in blasting, and relates more particularly to that type of cap disclosed in a prior patent issued to Mr. Daniels. The aim of the present invention is to simplify the construction of the cap and the means for securing the sleeve of water-proof material in place.

WINDOW-TENT.—G. R. SMITH, Arlington, Md. The purpose of this inventor is to provide a simple and inexpensive device especially adapted to protect a sleeper from dust, insects, and the like external annoyances, while at the same time permitting the sleeper to have all the advantages of sleeping in the open air.

SHAVING-STICK HOLDER.—J. F. O'BYRNE, Contact, Nev. This improvement is especially in soap holders designed for use for shaving purposes. The thimble and carrier form a handle for the soap and when it has been used down to the thimble the operator inserts his fingers in the end of a ring into engagement with the lugs and screws the carrier within the thimble to cause a little more soap to protrude, and this may be repeated until the soap has been consumed, except the small quantity which may have been passed through holes in the carrier plate.

MATCH-BOX HOLDER.—C. S. RADFORD, Philadelphia, Pa. The purpose of this inventor is to provide a device for holding any match box, especially those containing safety matches, in open position, and with both striking surfaces exposed, and which may be connected with a full box, and disconnected from an empty one with little trouble, and a minimum expenditure of time.

GOPHER-GUN.—F. M. AUSTIN, Beaverton, Ore.—In the gun devised by this patentee there is a supporting frame to enter the ground, and on which the gun frame is pivoted to be set at any desired angle. The gun frame carries a barrel which has a removable breach block that clamps the flange of the cartridge and carries the firing pin which is struck by the hammer when the trigger is tripped by the gopher.

Heating and Lighting.

REGULATING DEVICE FOR THE FEED-CONDUITS OF GAS-BURNERS.—E. STEIL, No. 14 an der Apostelkirche, Berlin, Germany. This invention refers to inverted incandescent gas burners in which the gas nozzle is removable, and it consists substantially in a self-closing regulating device arranged in the gas supply conduit and which will become operative as soon as the nozzle is removed from its seat, while when the nozzle is replaced the device will be moved into its open position again by the latter.

Household Utilities.

POST.—H. GARFINKEL, New York, N. Y. This invention relates to posts, the more particular purpose being to provide a post adapted for general use, and a particular value as a post forming a part of a bedstead. It is strong, ornamental, and cheaply constructed. It is made up largely of sheet metal, and various kinds of materials which may be obtained in large quantities at low rates.

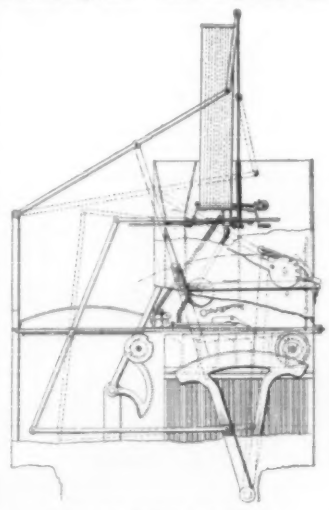
Machines and Mechanical Devices.

ADJUSTABLE-PADDLE PROPELLER-WHEEL.—J. H. B. MILLER, Eugene, Ore. The improvement pertains to a wheel designed for propelling in air or water, and also for use in obtaining power, as in submerged under-shot current water wheels, or in wind wheels. An object is to provide a device which will utilize the resistance of air or water to the greatest advantage, and yet offer the least resistance on the recovery.

CEMENT-BLOCK MACHINE.—F. H. HUBER, Glidden, Wis. This invention provides a mechanism for constructing cement blocks, partly automatic, rapid in its operation, and under manual control; provides a pressure mechanism for tamping the material as molded, regulated to a predetermined pressure; provides a manually controlled feed for the plastic material being used; and simplifies the construction and arrangement of the various elements entering into and forming part of this invention.

MOLD FOR CEMENT BLOCKS.—F. H. HUBER, Glidden, Wis. The principal purposes the invention has in view are: to provide a mold and bed therefor for the manufacture of cement blocks, to be quickly adjusted in position on the press; to provide a suitable mechanism whereby the molded block is released from the forming members; and to simplify the construction constituting the mold and operative members thereof.

VOTING MACHINE.—C. IA. LORRAINE, East Jordan, Michigan. The machine here illustrated has no springs, positive motions and gravity alone being used. The voter can see his ballot deposited. When the polls are closed



IMPROVED VOTING MACHINE.

the ballot boxes can be sealed before being removed. In canvassing the ballots and total vote for each candidate is shown at a glance. There are no number wheels, but votes are cast by means of balls dropped mechanically by the voter.

MOUTHPIECE FOR BOTTLE-WASHERS.—C. K. VOLCKENING, New York, N. Y. The more particular purpose here is to improve the mouthpiece used in connection with revoluble ferrules and brushes for washing the inside of bottles. More particularly stated, the inventor mounts within the mouthpiece a revoluble sleeve supported on ball bearings, and adapted to turn with the ferrule in such a manner as to prevent any friction upon the brushes as the latter are rotated.

LEVER MECHANISM.—J. F. CHILCOTE, Portland, Ore. The object of the invention is to provide mechanism for operating the winding gear of a hoisting engine, or similar devices, wherein both the winding and the tripping drum are operated by a single lever, thus leaving one hand of the engineer free for other purposes, as, for instance, to handle the throttle.

Prime Movers and Their Accessories.

STEAM-TURBINE.—I. OESTERBLOM, New York, N. Y. The object here is to provide a turbine arranged to utilize the steam to the fullest advantage both by impact and reaction, and to provide an unlimited number of reversals of the steam, the steam finally leaving the rotor practically at the same velocity as the peripheral speed of the rotor, thereby causing the residual kinetic energy of the steam to approach zero.

ROTARY ENGINE.—J. W. KEATING and A. MCDONALD, Portland, Ore. In this case the object of the invention is the provision of a rotary engine, requiring no valves for operating the parts of the engine proper, the rotor comprising oppositely arranged disks rigidly connected, which are moved into operative position by each other.

SMOKELESS MUFFLER.—B. DLOUHY, New York, N. Y. An object of this invention is to provide a muffler, arranged to deaden the noise of the exhaust gases and to deprive the same of smoke. For the purposes mentioned, use is made of a casing having a zigzag passage for the exhaust gases from the engine, and liquid jets for the gases, to condense the same and deprive the gases of smoke.

Railways and Their Accessories.

AUTOMATIC RAILWAY-SWITCH DEVICE.—R. Y. PARTIDA, Torreon, Mexico. The purpose in this invention is to provide a construction which will enable a switch to be opened and closed from the platform of the car so that the car may pass on or off the switch without requiring the motorman to leave the platform to open or to close the switch.

RAIL-CHAIR AND SPIKE.—I. D. ZITZERMAN, Kansas City, Kan. The intention here is to provide a chair for carrying railroad and like rails upon cross ties or other suitable supports, which can be easily mounted in position and as easily removed or replaced, which holds the rails securely in position, which prevents the accidental or other removal of certain of the spikes after they have been driven, and which holds the rails against lateral movement.

APPLIANCE FOR RAILWAY-CARS AND OTHER CONVEYANCES.—H. T. CRONK, New York, N. Y. In view in this invention is an appliance for railway cars, boats, etc., both private and public, to collect and retain waste, refuse, and offal as is usually indiscriminately disposed of along routes and highways, and to disinfect, render innocuous and prevent the communicability of any septic infections or diseases by said waste, until proper disposal of same can be made.

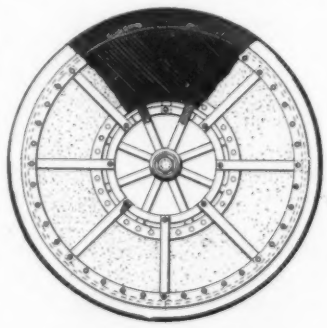
Pertaining to Recreation.

ROLLER-SKATE.—T. SPACIE, Chicago, Ill. This invention refers to improvements in skates disclosed in Letters Patent formerly granted to Mr. Spacie, wherein a resilient member is interposed between the supporting plate of the foot plate and the roller spindle plate, and the supporting plate and roller spindle plate pivotally connected to admit of the foot plate rocking relatively to the roller spindle and against the action of the resilient member. The present invention contemplates the provision of adjustable hangers between the supporting plates, and a pivot pin of the roller spindle plate.

Pertaining to Vehicles.

DERRICK.—A. P. HALD, Minneapolis, Minn. This derrick is adapted to be used for loading grain or other material from one wagon to another, or from a wagon to a granary; or to stack hay, and for a variety of other uses. An object of the invention is to provide a portable derrick, with a load support capable of moving in a rectilinear direction, and with means for rotating the derrick and hoisting on it, the load.

RESILIENT WHEEL.—FRANK HANK, 112 East 41st Street, New York, N. Y. In order to do away with common tire troubles, Mr. Hank has devised a wheel consisting of a disk of solid rubber braced by a rigid frame. Within a central opening in the disk is the hub of the



RESILIENT SOLID TIRE WHEEL.

wheel provided with short spokes and a rim bearing against the inner periphery disk. The outer periphery of the rubber disk also carries a rim in which a rubber tire is fitted. The rubber disk is intended to absorb shocks as does a pneumatic tire.

SPRING-WHEEL.—J. IAE, Oelwein, Iowa. This improvement has reference to spring wheels, and more particularly to such as have a channeled inner or spoke rim, an outer sectional rim and adjustable resilient shock absorbing means arranged between the spoke rim and the outer rim, the latter serving to carry the tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of June 18th, 1910, or will be sent by mail on request.

(12271) W. C. V. N. asks: What is the best way in which to leave a tubular steam boiler which is not in use during the summer months? It is used in steam heating. Is it best to drain the boiler, opening the handhole and the manhole, or is it better to fill the boiler full of water clear up into the steam pipe? A. Undoubtedly in a dry climate the steam boiler would be best left empty during the summer, and with the manhole plates off to allow free circulation of air. Along the seashore, however, the salt air causes rusting, and in such a climate it probably is better to fill the boiler to the top with water. Another scheme however has been worked, which is to put a small quantity of crude petroleum in the boiler, having first drained it dry, and then to fill the boiler with water slowly from the bottom, causing the petroleum floating on the surface of the water to coat the interior of the boiler. The water is then drawn off, the residue of the petroleum runs out after it, and the boiler is thoroughly greased inside and in condition to resist rusting for many months.

(12272) D. A. L. asks: Neglecting considerations of weight and convenience, is there more friction developed by a shaft say 100 inches long running in a tube or casing, surfaces of both tube and shaft being properly surfaced and lubricated, than when shaft is supported by say three bearings of reasonable surface (say 1½ inches each). Can I take it for granted that the larger the bearing surfaces, other things being equal, the better distributed the friction and weight of shaft, and hence its increased wearing quality without increased loss of power? A shaft running in a bearing floats on a film of oil. The resistance is principally due to the viscosity of the oil. If the oil is too thin for the load, it will be squeezed out, the shaft will touch the bearing, and the metals will cut one another. If the oil is thicker than necessary, it opposes an unnecessary resistance. Within limits, a long bearing distributes the strain over a larger surface of oil, and allows the use of thinner or less viscous oil. If the bearing were made extravagantly long, the oil could not be made thin enough and yet assure keeping the shaft from cutting the bearing, and its viscosity would increase the resistance to the revolution of the shaft. It is practically impossible to machine a long shaft and a long bearing perfectly true. For these reasons, shaft bearings are made comparatively short, varying from one diameter for heavy work, slow speeds and heavy lubricant, to six diameters for common line shafts and light oil.

NEW BOOKS, ETC.

THE GARDEN PRIMER. By Grace Tabor and Gardner Teall. New York: McBride, Winston & Co., 1910. 12mo.; 118 pp. Price, $1.

Of making garden books there is no end, and hardly a week goes by but another contribution is made to the already vast literature on the subject. The present volume is an excellent one, and is beautifully illustrated by charming plates printed in brown. There are the usual planting tables, which seem to be very complete both for flowers and vegetables. There is also a gardener's calendar giving the necessary work month by month; also tables relating to the spraying of insects. It is the purpose of this little book to set forth in the most direct form, but without technicalities, the fundamental principles of amateur gardening in America. It presupposes no knowledge of the subject, but rather aims to satisfy those who for the first time wish to make things grow and are in need of a trustworthy guide to going about it.

THE BOOK OF THE FLOWER SHOW. Charles H. Curtis, F.R.H.S. London and New York: John Lane Co., 1910. 16mo.; 109 pp. Price, $1 net, postage 10 cents.

No effort has hitherto been made to bring together those various items of information which a newly formed and reorganized horticultural society so often needs, and while the practice outlined is English practice, as the book comes from the other side, still, it is filled with information which can only prove of the greatest possible value to all who are interested in the production of flowers and vegetables for show purposes. The various rules are applicable anywhere, and the book certainly fills a long-felt want.

THE LIGHTKEEPER.—From time to time we have received copies of a remarkable little publication called "The Lightkeeper," which is issued by the Lighthouse Literature Mission of Belfast, Ireland, under the direction of Mr. Samuel H. Strain, Hon. Director. It is filled with most valuable matter interesting to ship owners, navigators, and lighthouse keepers. It is beautifully printed in various colored inks and is a most creditable production. The combination of a professional journal with a tincture of religion is a novelty, but the combination is not at all bad, and Mr. Strain is to be congratulated on the production of a unique periodical, which is issued from time to time as circumstances warrant. A sample copy is mailed for 40 cents. The Mission publishes an immense series of picture postal cards, showing nearly all of the lights of the world.

THE PRINTING ART. An illustrated Monthly Magazine of the Art of Printing and of the Allied Arts. Edited by Henry Lewis Johnson, Cambridge, Mass, 1910. The University Press. Vol. XIV. Quarto, 444 pp.; half leather. Price, $3.50.

To one who has watched each issue of "The Printing Art," from Vol I., No. 1, each succeeding volume is a thing to look forward to. Vol. XIV. is in no way inferior to its predecessors and in many ways shows the enormous increase in technical excellence, which even a few months bring forth. As a liberal education in the "higher typography" it has no peer. It is hard to cite examples from the rich storehouse of printerlore, but if anything is to be noted in the way of literary contents, the writer would cite an exceedingly valuable article on "Museum Labels" and one on the comparative legibility of types. Still it is almost unfair to note concrete examples where the average is so high. The beautiful color work and other examples of modern reproductive processes are of great technical excellence. The covers and all the advertisements are bound in, thus giving a completeness which cannot be given in any other way. Art is, after all, necessarily an ally of commerce, and the commercial end should not be forgotten for a moment. As we close the sumptuous volume, the words which rise to the lips are "well done." It is something in the world to do things well.

THE SHIPPING WORLD YEAR BOOK AND DIRECTORY FOR 1910. Edited by Major E. R. Jones. London: Shipping World offices, 1910. 16mo.; 1606 pp. Price, $3.40.

This ever welcome year book is a desk manual in trade, commerce and navigation. The present is the twenty-fourth edition. The tariffs are corrected to January 1, 1910, and include the new United States tariff. It has also, a complete port and harbor directory of the British Isles and a directory of all the commercial ports of the world, arranged in alphabetical order, giving particulars gathered from official sources, of accommodation, charges, tides, pilotage, towage, etc.; the tables of free-board, as revised by the Board of Trade; the acceptance by European nations of an international load line. The life-saving requirements are treated. There is also a vast amount of other material which is of the greatest possible importance to ship owners and those engaged in commerce. It is also a valuable book for general library reference. There is hardly a day that passes that it is not necessary to refer to this book. It is an admirable compilation.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

July 26, 1910,

AND EACH BEARING THAT DATE

[See note at end of list about copies of these patents.]

Abdominal bandage, J. Beltermann 965,556
Abrading machines, dust gatherer for, T. G. Plant 965,223
Acenaphthene quinone, etc., condensing reduction products of, K. Elbel 965,170
Adding and listing machine, W. J. Roche 965,410
Adding machine, J. G. Vincent 965,423
Aerial machines, apparatus for operating planes or wings and rudders of, J. L. Garsed 965,289
Aeroplane, L. R. Adams 965,792
Agricultural implement, J. N. Parker 965,736
Air and automatic emergency brake apparatus, straight, W. V. Turner 965,615
Air and steam coupling, automatic, J. V. Robinson, reissue 13,138
Air brake, combined automatic emergency and straight, W. V. Turner 965,613
Air brake, duplex automatic and straight, W. V. Turner 965,614
Air brake system, duplex, W. V. Turner ... 965,612
Airship, L. H. Barringer 965,682
Alidade, cross-bearing, B. V. How 965,462
Alizarin preparation and making same, E. Franke 965,804
Amusement apparatus, W. S. Van Sant 965,768
Amusement apparatus, roundabout, F. E. Mendenhall 965,644
Animal covering, L. E. Palmer 965,834
Animal trap, J. Opperud 965,318
Animal trap, H. R. Arbuckle 965,618
Armband threading and lever buckle slide, E. N. Humphrey 965,301
Article of manufacture, Pistor & Rakowica. 965,485
Auditor's combination report, N. F. Garbo .. 965,703
Autographic register, P. Hano 965,706
Automobile cooler, Hyde & Gordon 965,189
Automobile wheel, C. Rasmussen 965,539
Automobiles, demountable rim for, C. Johnson 965,715
Axle, front automobile, J. Garlick 965,288
Baby stand, P. F. Meyer 965,476
Bag holder, W. Ballard 965,560
Bag holder, M. C. Parrish 965,737
Baking iron, C. Marcucciilli 965,475
Balance wheel, compensating, F. Ecanbert .. 965,505
Baling press, F. A. Ryther 965,750
Banjo finger rest, W. H. Crown 965,691
Barrel hanger, W. A. Johnson 965,526
Barrel head, I. Francis 965,803
Barrel, tumbling, H. M. Greist 965,813
Beds, crib attachment for, R. J. Holt 965,522
Bedsteads, connection fitting for, E. Vaughn 965,769
Belt fastener, M. Weixler 965,777, 965,778
Bolting, V. L. Sturges 965,250
Beveling machine, A. H. Prenzel 965,744
Bicycles and the like, package carrier for, H. G. Brott 965,436
Billiard cue chalk holder, L. F. Dahl 965,444
Binder, loose leaf, J. C. Dawson 965,373
Boat releasing hook, J. Y. Porter, Jr 965,655
Boiler furnace, G. de Grahl 965,292
Bolster, J. M. Rohling 965,228
Bolt cutting mechanism, Z. B. Coes et al .. 965,156
Bolt machine, E. C. Henn 965,184
Bolter, J. Forrest 965,447
Book holder, A. M. Limpus 965,720
Bottle closures, means for attaching, S. J. C. Wilkinson 965,784
Bottle cooling device, J. J. Lane 965,307
Bottle handling device, T. Holz 965,629
Bottle, non-refillable, J. Humphrey 965,524
Bottle, shaker, J. L. Dunnock 965,165
Box covering machine, W. B. Paton 965,738
Braiding machine, Brown & Beach 965,457
Brake shoes, magnetic, Cockshott & Maley. 965,798
Brick machine, C. S. Wert 965,350
Briqueting machine, G. W. Herbein 965,298
Brooder, P. R. Park 965,650
Broom nailing machine, S. C. Lay 965,588
Brush back, S. G. Wilson 965,786
Brush, fountain tooth, F. L. MacDonald 965,309
Bucket, dumping, A. W. French 965,511
Bucket ear, H. L. Pague 965,732
Bucket, minnow, C. Sonke 965,662
Buckle, S. Warren 965,425
Buckle for use on suspenders, C. S. Comstock 965,370
Buggy top and rein and robe holder, Combined, A. Hitt 965,459
Bung extractor, J. S. McLeroy 965,481
Burner, D. L. Reese 965,407
Button loop for overalls, A. E. Plowman ... 965,405
Cabinet and paper therefor, J. Welsh 965,780
Cabinet, kitchen, J. E. Tate 965,253
Cable button, J. Penglase 965,739
Camera, E. L. Hall 965,516
Camera shutter and means for operating the same, L. C. Knee 965,389
Can for maple syrup and the like, J. Vincent 965,256
Can lock, milk, J. Lokody 965,580
Can spout attachment, A. L. Whitney 965,782
Can vent protector, F. G. Dickerson 965,709
Candlestick, miner's, D. B. Beaton 965,500
Canned goods, machine for shaking, F. H. & F. R. Flounders 965,802
Car, convertible freight, S. C. Lindsay 965,203
Car coupling mechanism, motor, L. Gremi .. 965,814
Car door, Salsbury & Couch 965,751
Car door opening and closing mechanism, G. W. Voigt 965,770
Car, dumping, J. L. Baker 965,795
Car fender, G. Dysinger 965,167
Car fender, automatic safety, I. Ksiazek ... 965,199
Car, railway, C. L. Schwartz 965,232
Car safety appliance, railway, J. T. Andrew 965,679
Car sand box, G. H. Monroe 965,212
Carbid feed mechanism, A. E. Schlieder 965,756
Carpet holder, H. J. Boger 965,265
Cartridge, blank, L. B. Purcell 965,745
Case. See Display case.
Cash register, F. K. Fassett 965,509
Casket, canopy, Meizer & Rademacher 965,643
Caskets, adjustable bottom for burial, T. A. Lynch 965,641
Cattle chute, P. G. Heneon 965,297
Cement brick press, C. M. Starr 965,247
Centrifugal separator, J. J. Berrigan 965,558
Chain repairing implement, J. N. Macdonald 965,722
Channeling machines, adjustable work support and gage for, A. H. Prenzel 965,656
Charging switch, W. S. Henry 965,456
Check controlled mechanism, H. V. Westervelt 965,427
Check controlled apparatus, M. J. Walther. 965,547
Check devise, manifold, F. B. Jordan 965,527
Chimney cover, D. A. Clayton 965,563
Chuck, lathe, H. C. Nelsen 965,216
Chute, W. Drever 965,624
Cider mill, G. L. Putt 965,486
Circuit breaker, J. Young 965,549
Circuit controlling apparatus, time, A. P. Nelson 965,534
Circuits, multiple drop hoist system of, A. M. Coyle 965,442
Clamp. See Hydraulic safety clamp.
Clutch, W. W. Prather 965,325
Clutch, H. Tscherning 965,610
Clutch, automatic, O. C. Talbot 965,606
Clutch, electric friction, L. H. Dyer 965,166
Clutch mechanism, W. C. Zelle 965,270
Collapsible table or seat, M. Smiljanic 965,338
Collar fastener, C. Tompsett 965,688
Collar fastener, animal, Meyer & Silversmith 965,210
Collar stiffener, N. Simon 965,416
Collar stiffener, garment, R. Gaspard 965,383
Concrete construction, P. Aylett 965,357
Concrete construction system, P. Aylett 965,358
Concrete reinforcing structure, E. E. Nickson 965,729
Concrete post, D. Eskew 965,700
Concrete roadway, oil, E. M. Chadbourne ... 965,562
Concrete wall mold, ventilated, H. T. Frost 965,805
Cord or other material, manufacture or treatment of lengths of, T. Sloper 965,240
Cotton chopper, J. Deschamp 965,572
Cover for desk contact implements, sanitary, G. H. Contes 965,564
Crabs and other crustacea, apparatus for picking, C. F. Greiner 965,706
Cream cooler and aerator, pasteurized, E. S. Snively 965,604
Cream ripener, H. Christensen 965,687
Cultivator, F. Divin 965,376
Cultivator and furrow marker, combination, S. Schaller 965,411
Cultivator and seeder, combined, W. Foy ... 965,702
Cultivator attachment, C. J. Rowles 965,230
Cultivator, irrigating, E. F. Douglas 965,623
Cultivator replanting attachment, Engstrom & Page 965,801
Cuprammonium solution, making, H. Bernstein 965,273, 965,557
Curtain fixture, R. Reubel 965,658
Cutter. See Vegetable cutter.
Cutter bar, Poole & Abbenzeller 965,654
Damper regulating apparatus, J. B. Crandon 965,569
Derricks, mast step for, C. H. Peters 965,741
Die stock, H. W. Outer 965,320, 965,403
Die stock reamer attachment, G. Reeb 965,657
Display box, F. K. Andrews 965,690
Display case, W. F. Shaffer 965,237
Display cases or similar structures, joint for, D. E. Hunter 965,525
Display rack, merchandise, A. T. Edwards. 965,169
Distillery slop to dry feed, reducing, E. A. Hoffmann 965,521
Door catch, screen, J. L. Zeiger 965,791
Door fastener spring, S. F. Stevenson 965,518
Door stop, G. J. Poeppelmeier 965,527
Doors, paneling, H. W. Phillips 965,220
Draft equalizer, H. O. Turner 965,345
Draft rigging, G. Hargreaves, Jr 965,183
Draft rigging, J. M. Dutelle 965,446
Drafting instrument, H. F. Noyes 965,483
Drawer for card catalogues, E. D. Hayes .. 965,517
Drier. See Grain drier.
Drill hole testing apparatus, M. Garvey ... 965,808
Drill room floor, R. R. Bradley 965,366
Drying goods, L. von Susskind 965,251
Dumb-bells, spring grip attachment for, W. J. Dossetter 965,284
Dust collector, hand propelled, F. C. De Vallant 965,694
Dyeing machine, W. A. Fowler 965,675
Dynamos, automatic potential regulator for, J. J. Mueller, Jr 965,396
Edge trimmer, A. J. Johnson 965,192
Electric cable, W. Geipel 965,810
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Engines, supplying fuel to heat, G. F. Jaubert 965,632
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Envelop, J. J. Zasmeta 965,209
Envelops, machine for applying metallic fasteners to, W. E. Swift 965,252
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Escapement regulator, compensating, F. Ecaubert 965,503, 965,504
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Evaporator, A. S. Morris 965,395
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Explosives, device for thawing, G. S. Sneer. 965,599
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Feed bag and support therefor, J. F. Hammel 965,180
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Keyless lock, D. B. Kimsey	965,303
Knitting machines, duplex stripping mechanism for circular, W. P. Young	965,428
Knitting machines, yarn changer for circular, H. H. West	965,351
Knob lock, W. A. Hill	965,519, 965,520
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Ladder and scaffold, combined, R. A. Holdridge	965,712
Lamp, W. C. Coleman	965,439, 965,440
Lamp, E. M. Rosenbluth	965,749
Lamp chimney attachment, C. D. Huddle	965,523
Lamp cluster, G. A. Harter	965,296
Lamp or lantern burner, A. F. Prahm	965,597
Lamp receptacle, incandescent-electric, A. Weber, Jr.	965,258
Lamp socket, electric, F. P. Poole	965,743
Lamp socket, incandescent, N. Marshall	965,206
Lamp support, carriage, H. L. Cowles	965,158
Lamp, vehicle, I. H. Atwood	965,551
Last, shoe, L. A. Cook	965,585
Latch, gate, C. C. Shoff	965,238
Lead refining and desilverizing apparatus, G. P. Hulst	965,464
Leather and manufacturing the same, reinforced, E. Weinheim	965,261
Leather board and preparing the same, waterproof, Buffum & Carter	965,152
Lenses, instrument for measuring and determining the axes of, G. Moe	965,211
Letter slot attachment, J. Popenhagen	965,225
Level, J. L. Russell	965,659
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Lighter, pocket, L. V. Aronson	965,149
Lightning rod, electric cable, L. L. Mast	965,297
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Liquids, concentrating, P. Kestner	965,822
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Magneto generator, L. W. Noyes	965,484
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Manhole cover, O. T. Dougherty	965,163
Manifolding device, G. H. Robinson	965,227
Match box and supporting rack, combination, L. D. Keiso	965,468
Match box holder, W. B. Seeley	965,603
Matrix plate, G. W. Clarke	965,155
Mattress, P. Klimowicz	965,637
Measuring and recording machine, A. B. Booth	965,434
Measuring instrument, T. J. Pitts	965,324
Meat roller press, Schmidt & Naegelen	965,336
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Mechanical movement, K. Hoepfner	965,460
Metal bending machine, J. E. Erickson	965,171
Metal cutting tool, C. K. Lassiter	965,587
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Motor controller, electric, G. H. Whittingham	965,673
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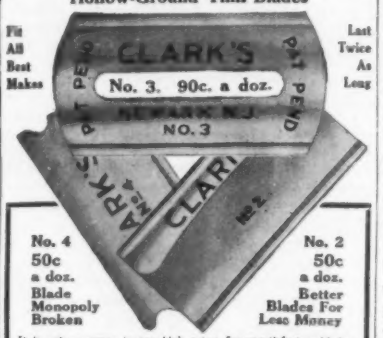

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THE MECHANICAL SIDE OF CONEY ISLAND.

(*Continued from page 104.*)

a sense of security at least by the presence of an attendant. There seems to be little improvement in the "shoot-the-chutes," and thousands still continue to take the thrilling ride down the inclined plane and enjoy the concussion of the boat with the pool as much as ever. In Steeplechase Park there is a ride which, while it is not new, never fails to please; this is the Steeplechase Ride, in which the equestrian sits astride a hobby-horse running on a sinuous track which trends back and forth at varying elevations. The tracks are parallel so that friends can ride side by side if they are the same weight and trim their bodies according to the un-thought-of and unappreciated laws of physics, otherwise they are apt to finish at separate times. Our engraving shows six riders being hauled up to the starting point from which they depart for their ride. In the same amusement park there is a rather curious illusion which is called the "Roof Garden." There is an elevator which bears the sign "To Roof Garden;" after the purchase of a ticket a uniformed attendant closes the gate and pulls a rope, then comes a deafening crash and back tilts the car, simulating a serious accident; the floor is oiled so that escape is very difficult until the fake car is righted. The engraving shows the construction of the car. Truly a little thing amuses some people. Distorted mirrors are other amusement devices which never fail to bring out peals of laughter. The wonder is where such mirrors were obtained in such endless and amusing variety. One of our engravings shows a little girl looking in awe-struck silence at the transformation. There are many mirrors making thin people fat, elongating short persons to the height of "Chang," and reducing the avoirdupois of others to satisfactory limits. In Luna Park is an innocent-looking bench near the statue of a benign appearing boy on a pedestal; hardly is one seated than the bench gives way and the statue leans forward in a menacing fashion. Our diagram shows the pivoted bench and the hinged statue connected by levers.

Swings of various types furnish quite a fertile field of invention. The "Double Whirl" shown in our engraving is an exceedingly ingenious swing, merry-go-round, and miniature Ferris wheel combined. The whole structure revolves while the wheels with the suspended cars themselves turn in another plane like a miniature Ferris wheel, the actual seats retaining their equilibrium during the ride. In Luna Park is also a curious pneumatic tube largely constructed of concrete, the ride being about three thousand feet long. Instead of using the air pressure, the cars are hauled by creating a vacuum by exhausting air in front of them. It only takes about two minutes to make the entire journey. The oviform cars are provided with a wire netting which is secured so that the travelers will not have their hands and heads injured. One of the features of Luna Park have always been the miniature locomotives which have carried trains over the grounds. Mr. Hugh Thomas, the electrical engineer of the park, has done away with steam and installed electric motors instead, the current being taken from two third rails. The effect is extremely realistic as the motors are encased in double-ended cabs such as are in use on many electrical railways of larger growth. The "Witching Waves" is also in operation at Luna Park and Mr. T. Van Kannel has an improved edition of this excellent amusement device down on the "Bowery." In the design illustrated in our issue of August 15, 1908, the track was not continuous, a succession of rapids having to be provided to propel the cars at the ends. Now, however the device is so arranged that the undulatory mechanism is not only placed at the sides, but takes care of the ends as well by being endless. This causes a positive and continuous move-

(*Concluded on page 113.*)

Paper feeding machine, T. C. Dexter..... 965,693
Paper making machinery, H. L. Ormman... 965,319
Paper treating machines, automatic discontinuing device for, Fischer & Wescher. 965,576
Parer, fruit, G. W. Gates..... 965,513
Paving rammer, Nordstrom & Qvist..... 965,218
Pedestal, J. Lehman..... 965,471
Pencil attachment, W. L. Selleck..... 965,235
Pencil sharpener, E. B. Welles.....965,262, 965,263
Penholders, ink scraper attachment for, J. E. Shouse 965,239
Percussive apparatus, self-feeding, W. Mauss 965,828
Phenols and aldehydes, hardening condensation products from, H. Lebach..... 965,823
Pianos, expression mechanism for self-playing, P. Wuest..... 965,354
Picture framp, knockdown adjustable, E. J. Dreisbach 965,377
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Pistol, G. A. Hansen..... 965,386
Piston and piston valve, R. Allen..... 965,355
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Pocket, pencil holder, F. A. Weeks..... 965,669
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Post. See Concrete post.
Potato digger, P. A. Thompson..... 965,667
Powder box, W. R. Gillette..... 965,291
Powder press, A. G. Cummings..... 965,371
Power transmitting apparatus, J. Dunlop... 965,285
Power transmitting mechanism, T. F. Weiland 965,348
Press, W. Klocke..... 965,529
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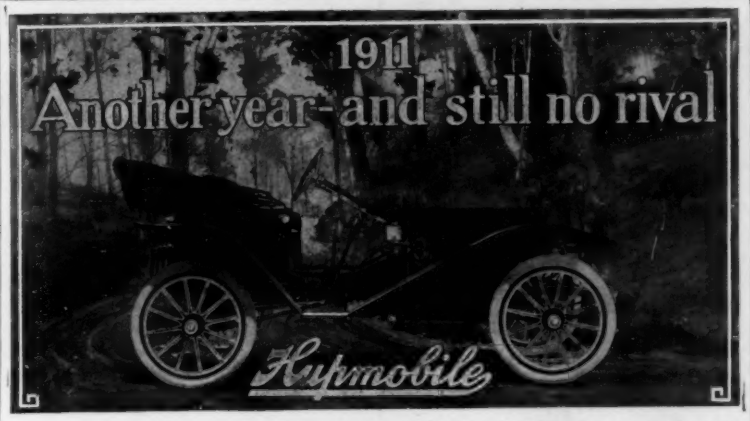

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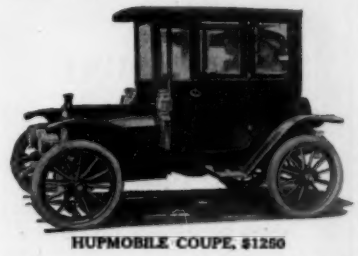

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(*Concluded from page 112.*)

ment; one 10 horse-power motor serves to actuate the entire system. The bell cranks have been done away with and ordinary cranks are substituted. The cars have also been improved.

It will be curious to note what another year will bring forth in this delightful pleasure center which is the dean of all such places.

A Universal Differential Pressure Chamber.

(*Continued from page 102.*)

neck, the bulging of which collar is prevented by guillotine shutters. The operator can see the patient's face, and the anesthetizer the body—not directly, however, but through a mirror; and attention is, therefore, not distracted from the work of anesthetizing. The anesthetizer and the head of the patient are in the smaller positive differential pressure chamber, which is of size ample for the use of oxygen and other apparatus, and has an airlock providing access and egress while the pressure is on, and without interruption thereof; from this chamber the ether fumes are ventilated off every minute.

The operating chamber needs no air lock. Its pressure can at any time be raised from negative to atmospheric pressure, while the differential pressure required for the operation is being maintained without interruption, so that the door leading to the outside can then be opened. A triple reserve is provided in case of breakdown. There are two independently driven sets of pumps—one for pressure, and one for vacuum; so that in case of any mishap to one unit an immediate change can be made from one kind of differential to the other; in the event of accident to both units a hand pump is provided, for maintaining the positive differential pressure in the anesthetizing chamber. The motors run at constant speed. The variation of the air pressure in the chambers is effected by manipulations of two air valves, set by hand to the desired gage readings—a matter so simple that mistakes are excluded. The valve is simply a cock.

The chamber is of knockdown construction and transportable; there is nothing about it to get out of order. Two different materials are used: iron, which forms a light open framework, sufficiently strong to resist air pressure, and requiring for its construction nothing foreign to everyday structural iron work routine, and balloon material, which is air-tight and is kept to the desired shape by the framework. In the positive pressure chamber the fabric is arranged inside the metal frame; in the negative pressure chamber the fabric is outside the framework. This structure was built to withstand hard usage; and it has had it. Truckmen, railwaymen and others have done their worst with it. It has repeatedly been tested and retested; it has been erected, knocked down, carted from place to place, transported to various hospitals in various cities. One man and a helper can knock it down in about an hour; they can put it together again in less than four hours; soldiers especially drilled should do it in even less time. It is practicable in war. It is disinfected by formalin vapors, which are ventilated off by the pumps.

This structure belongs neither to the kind of apparatus that works from atmospheric pressure downward, nor to that working from atmospheric pressure upward. It is *sui generis.* The aim in its construction has been to overcome and remove the limitation of differential pressure chambers to atmospheric pressure as the fixed basis at one end of the difference in pressure; and to enable the establishing of the basis anywhere above or below, or at atmospheric pressure, at will. This was accomplished by combining two differential chambers in one apparatus, in which these modifications were possible: (1) The rooms may be separate; (2) they may have one corner in common; (3) or one wall in common—in all which

(*Continued on page 114.*)

Classified Advertisements

Advertising in this column is 75 cents a line. No less than four nor more than 10 lines accepted. Count seven words to the line. All orders must be accompanied by a remittance. Further information sent on request.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. There is no charge for this service. **In every case it is necessary to give the number of the inquiry.** Where manufacturers do not respond promptly the inquiry may be repeated.

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AMERICAN CAPITALISTS traveling abroad at present time are invited to inspect two wonderful inventions, both of which will entirely revolutionize trades in their respective classes. Articles in question are fully protected by patents all over the world. Advertisers require interested parties to exploit and manufacture goods in America and Canada, which fields are not at present being worked.

Capitalists are invited to write to American representative of the firm who is at present in Berlin at the factory, making an appointment to visit the factory there and witness the inventions in operation, it being absolutely necessary to do this in order to appreciate the wonderful inventions offered. Principals only treated with.—Address for interview and full particulars to F. Nolte, care Wm. Graff & Co., Linkstrasse 17, Berlin.

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FOR SALE.—U. S. and Canadian patent dress chart. Sample cut of five suits, any cloth. We must sell quick. Write to me. S. Komura, Chapman and Emory Sts., San Jose, Santa Clara Co., Cal.

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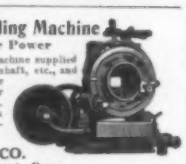

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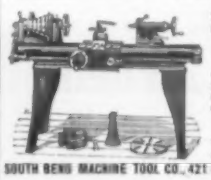

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Style No. 1 - Stationary Type - Price, $300.00

MANUFACTURED BY

TABER PUMP CO.

Address Motor Dept. BUFFALO, N. Y

(*Continued from page 113.*)

the two rooms can be either outside each other or one inside the other; and (4) two rooms may be one partly outside and partly inside the other one. Meyer selected the combination of two separate rooms, one inside the other.

The following air pressure combinations can be made:

1. Pressures in both chambers deviate in the same direction from the open air.

A. Inner positive chamber combined with outer positive chamber.

B. Inner negative chamber combined with outer negative chamber.

2. Pressures in both chambers deviate in opposite directions from the open air.

C. Inner positive chamber combined with outer negative chamber.

D. Inner negative chamber combined with outer positive chamber.

The positive chamber in the negative chamber (2 C) is that devised by the Meyers; and now used in the Rockefeller Institute in New York city. It was selected for construction because: (1) it enables the nearest approach to operating in open air by building up the differential pressure of one-half positive and one-half negative pressure; (2) the anesthetizing room can be used independently as a positive pressure chamber—as in the Brauer apparatus; and (3) the anesthetizing chamber can readily be transformed into a negative chamber in the negative chamber (1 B) by simply reversing the motor of the pump that ventilates the anesthetizing room, so that the pump is converted from a blower into a suction pump. If the valves are now set to produce higher rarefication of air in the operating chamber than in the anesthetizing room, the latter remains relatively a pressure chamber; and, by maintaining the proper differential the thorax can safely be opened with negative pressure over the mouth as well as over the open thorax. For example, an operation was done under such conditions with a local barometric pressure of 760 millimeters (29.721 inches) Hg., 744 millimeters (29.291 inches), over the open thorax, and 750 millimeters (29.527 inches) over the patient's mouth; which is equivalent to doing the same operation at a higher altitude than that in which the work was done.

By merely ventilating the outer room at atmospheric pressure and putting the inner room under increased pressure, the two combined chambers become simply a positive differential pressure apparatus.

Thus in this Meyer apparatus operations can be done: (1) under positive differential pressure; (2) under negative differential pressure; (3) under part positive and part negative differential pressure; (4) under a gradual change from positive to negative pressure, and *vice versa;* (5) under a repeated change from positive to negative differential pressure and *vice versa;* (6) under negative differential pressure at an altitude above sea level higher than that of the place where the operation is done; (7) under negative differential pressure as in (6), but at gradually or repeatedly changing altitudes. Therefore this apparatus is rightly termed a "universal differential pressure chamber;" and the narcotizing room, when independently employed, is termed a "positive differential pressure chamber," because it must always and under all circumstances have a higher pressure inside than outside of it.

Space will not permit a detailed consideration of many most interesting factors: for instance, how the combination 1 A is not likely to be used, since it would in effect be lowering the patient's open thorax into a shaft below the surface of the ground, and depressing the patient's mouth still further. On the other hand, the combination 2 D should have importance, not in thoracic surgery

(*Concluded on page 115.*)

How to Protect Your Tires

The constant dread of a sudden puncture or blowout is a fear of the past to all users of

Standard Tire Protectors

for they enable you to come and go, day in and day out, without the least bit of anxiety. Your repairing bills take a sudden drop, reducing the cost of maintaining your machine to a practical figure.

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Save Time Work Worry

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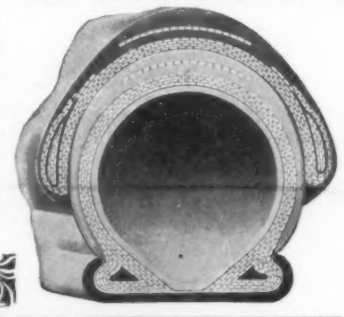

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(Concluded from page 114.)

—because negative pressure at the mouth and positive pressure at the open thorax would accentuate the pneumothorax—but in cranial surgery, because by means of it the blood can be drawn away from the brain, and by varying the pressure the quantity of blood thus temporarily withdrawn from circulating through the heart can be controlled. (In this latter combination the patient's body is put into the inner chamber.) Again, in a case of collapse, artificial respiration was produced with the positive differential chamber by rhythmic movements of the valves handle, increasing the pressure quickly, and lowering it again to atmospheric pressure.

To what pressure can the operator and his assistants expose themselves? Where is the danger line? Even should the negative chamber be exhausted to a differential pressure of 50 millimeters (1.968 inches) Hg., thus being strained to the limit of its capacity, they would still be within the limits of possible everyday experience; for in our climate barometric fluctuations of 50 millimeters Hg. are nothing unusual. The differential pressures used in thoracic surgery seldom exceed 7/8 millimeter (0.276-0.315 inch) Hg., corresponding to a difference in altitude of from 250 to 300 feet; that is, the patient's mouth is lowered about 300 feet below his opened thorax. However, surgeon, assistants, anesthetizer and nurses are not under differential pressure at all; their entire bodies are under only one pressure.

This combination of medical and engineering science was begun early in 1908. Numerous difficulties were met; on December 23rd, 1909, the Universal Differential Pressure Chamber was tested; it was first used in the Rockefeller Institute on January 8th, 1909; on May 7th, 1909, it stood complete, as here described.

It may be *apropos* to consider briefly, other contrivances by which atmospheric changes are made for medical purposes. There is the Kuhn pulmonary suction mask, which at two hourly intervals is placed over the nostrils and mouths of sufferers from pulmonary tuberculosis asthma, anemia and certain heart affections, the purpose being to produce a rarefaction of the air in the chest, with a consequent hyperemia. Then there is the pneumatic cabinet, which Dr. C. E. Quimby and other physicians in this city have for at least a decade past been using for pulmonary and cardiac affections. On entering this cabinet one breathes the ordinary atmosphere from without through a rubber tube, while he is subjected to negative pressure. An odd sensation here is that in expiration one has actually to push out the air from one's lungs, and with some little effort. Another is a compressed air chamber, seemingly as large as a fair-sized living-room; there is at least one of these in London, though I do not know of any in New York city.

To return to the Meyer apparatus: One reaches the most satisfying conclusion that, in view of the numerous pathological conditions which occur in the human chest, many operations can be done in this region, by means of this apparatus as safely as anywhere else in the economy. One may work thus under differential pressure, whether or not there are adhesions between the pulmonal and costal pleura. Deep stab and shot wounds of the chest may be repaired; tuberculosis cavities and abscesses—gangrenous and otherwise—may be opened and drained, the ordinary operations upon the pleura will be done with greater ease and safety; the mediastinum and the cardia may be invaded much more frequently and securely than formerly; foreign bodies will be extracted from bronchi when located by the X-rays; portions of diseased lung may be excised; one or more lobes, even the entire lung, may be amputated.

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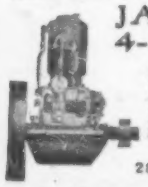

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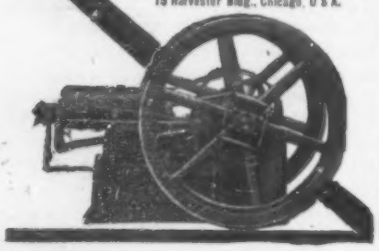

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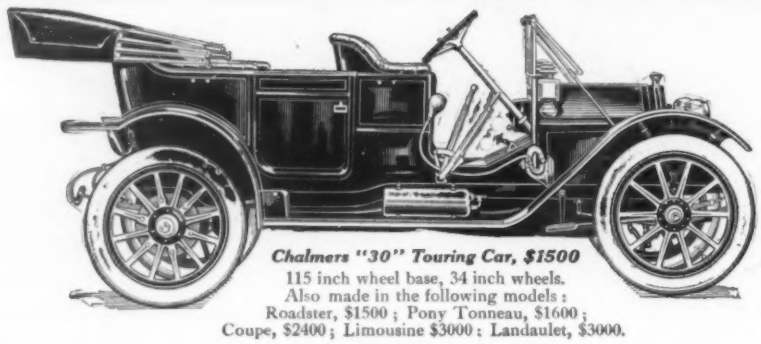

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Announcement of 1911 Models

IN announcing the Chalmers models for 1911, the most noteworthy fact is that in all vital features they remain the same as the cars that have created world's records for efficiency, endurance and speed—such as winning the Indiana and Massapequa trophies—blazing the way from Denver to Mexico City and mapping the path for the Glidden Tour of 1910. Trade papers last year gave the Chalmers the title of "Champion Cars."

The best evidence of Chalmers merit, however, is not the trophies won in tests of all kinds, but thousands of satisfied users, the majority of whom have the means to purchase cars of any kind.

The people who buy Chalmers cars are those who know how to judge motor car values regardless of prices and advertising claims.

Many of the Chalmers buyers are of the class to whom money does not have to be an object. People who can pay any prices constantly show their preference for the medium-priced Chalmers.

Look over the list of automobile buyers in your own community and see if these statements are not true. Talk to some of the Chalmers owners; their enthusiasm will prove our claims.

In general, the greatest improvement on the 1911 Chalmers consists in refinement of detail, like the artist's final touch to the masterpiece. Lines have been beautified in body and fender, so that—viewed from any angle—no car, whether it costs $5,000 or more, affords more eye-delight than the Chalmers.

On luxury-priced cars, the purchaser naturally expects not only the highest standard of workmanship, but the most costly materials, whether upholstery, trimmings or paint. Never before has it been possible to duplicate this excellence in a moderate priced car—for example, the Chalmers "30" receives sixteen coats of paint, requiring five weeks to finish it.

In detail—the curves just back of the tonneau doors have been straightened out, making the low, rakish, straight-lined bodies which every maker strives so hard to obtain. The seats have been lowered, adding materially to the riding comfort.

The tonneaus of both "30" and "Forty" have been made longer and wider. The fenders have been changed slightly, adding to the graceful appearance of the car and at the same time affording greater protection from water and mud.

On the Radiator.

The angle of the steering post has been changed slightly so as to allow more space between steering wheel and driving seat.

The brackets supporting the running boards are fastened inside the frame, making the exterior of the car appear perfectly smooth.

Note the wide, beautiful doors. Hinges and door locks are furnished by a famous lock manufacturer; no better can be bought.

On the "30" the dash, heel boards, and the door strips are of black walnut, on the "Forty" Circassian walnut. All handles, mouldings, levers, etc., are shapely and massive.

The battery box has been placed under the tonneau floor and a tool box big enough to hold a pump placed on the left running board, a change that every driver will praise.

Both the "30" and" Forty" motors remain unchanged in principle, although small refinements of details and workmanship insure that they will be even smoother running and quieter than ever before, without sacrifice of power, which is too often the case in so-called "silent" cars. New style carburetors are used on both motors and their economy and uniformity of operation under all conditions will surprise every buyer.

On the "30" we furnish a Bosch magneto, big new-style gas lamps, Prest-O-Lite tank and a special Chalmers top—all for $200 additional.

These tops, of special Mohair or Pantasote, are made in our own shops and designed to fit and look best on Chalmers cars. They are equal in quality to tops furnished on the highest priced cars.

As in former years, the Chalmers principle is not to make as many cars as possible, but to make them as good as possible. Chalmers cars are built on a quality, not a quantity basis. We regret that we could not furnish cars of the 1910 models for all who wanted them. We fear that some may have been offended at being told they could not get the cars they wanted. It is sometimes harder to tell a man he can't have a thing than to show him why he ought to have it.

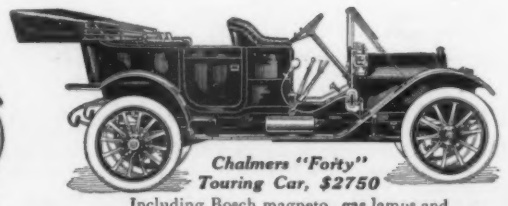
We would like to take care of everyone who wants a Chalmers car, and yet it is not our ambition to build cars in very large quantities; hence we would advise you to place your order early.

Demonstrating cars are being sent to our dealers all over the country this month. Deliveries to customers begin August first.

Write for the new catalog "R" and name of the nearest dealer.

Chalmers Motor Company
Detroit, Mich.
(Licensed under Selden Patent)

Chalmers "Forty" Torpedo Body, $3000
Including Bosch Magneto, gas lamps, Prest-O-Lite Tank and five demountable rims.
122 inch wheel base, 36 inch wheels.



Chalmers "Forty" Touring Car, $2750
Including Bosch magneto, gas lamps and Prest-O-Lite Tank, 122 inch wheel base, 36 inch wheels.
Also made in Roadster Model at the same price.